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THE ORIENTATION OF CELLULOSE IN THE SECONDARY WALL OF TRACHEARY CELLS

I. W. BAILEY AND MARY R. VESTAL

With plates 206–208 and three text figures

INTRODUCTION

MUCH ATTENTION has been focused, in recent years, upon the study of the arrangement of chain molecules, micelles, and fibrils in the cell walls of the cotton hair, bast fibers, tracheids, and other types of commercially important fibers. Various methods of studying the arrangements of the structural units are employed by different investigators:

1. The study of visible fibrils and striations, based upon the assumption that the long axis of the micelles is oriented parallel to these structures.

2. The study of pit-orifices and of mechanically induced cracks, based upon the assumption that these structures are oriented parallel to the fibrillar axis.

3. The study of extinction angles, of dichroism, and of other phenomena in polarized light.

4. The study of X-ray diagrams.

Each of these methods yields significant data under favorable circumstances, but each is subject to serious limitations when applied to miscellaneous types of cell walls.

Even when coarse aggregations of fibrils and striations are clearly visible in surface views of unswollen secondary walls, it frequently is difficult to determine with certainty, whether a specific orientation occurs throughout the wall or in one of its layers only. Swelling the wall to reveal its finer structure is effective in dealing with the broad central

layers — provided allowances be made for distortions due to longitudinal contraction and lateral expansion — but such treatments commonly disrupt and conceal the structure of the tenuous inner and outer layers.

In the case of thick secondary walls of the 3-layered type, the long axis of the slitlike pit-orifices is oriented parallel to the fibrillar axis of the central layer, but affords no evidence regarding the fibrillar arrangements of the inner and outer layers. In thin-walled cells, the orifices of the pits commonly afford no clue regarding the fibrillar orientations of any of the layers. Similarly, mechanical cleavages or seasoning cracks may afford valuable evidence in the case of layers which have pronounced radio-longitudinal or radio-helical porosities, but are difficult to interpret accurately in the case of other layers.

Phenomena visible under the polarization microscope are significant where material can be oriented so that the polarized light passes through single layers; but accurate interpretations are difficult where the light passes through several superimposed layers of varying thickness and of different fibrillar orientations. Thus, in the case of transverse sections of 3-layered secondary walls, it is possible to demonstrate that the fibrils of the central layer are, on an average, oriented more nearly parallel to the long axis of the cell than in the case of the inner and the outer layers; but it is difficult to determine in longitudinal sections whether the orientation of the latter layers is actually at right angles to the long axis of the cell or at some intervening angle.

Similar obstacles must be overcome in the interpretation of X-ray diagrams where the rays pass through a complex of layers of markedly varying thickness and of very different structural orientations.

In view of such technical difficulties as these, it is not surprising to find many contradictory statements in the literature concerning the structural arrangement of cellulose in the walls of specific cells. It obviously is essential to develop a technique which will enable the investigator to trace the details of fibrillar orientation throughout each of the successively formed parts of the secondary wall. The method recorded in the following pages appears to be of considerable value in the study of lignified tissues.

METHOD OF DEMONSTRATING THE FIBRILLAR ORIENTATION IN LIGNIFIED WALLS

When sections of lignified tissues are chlorinated, rinsed in 95% ethyl alcohol, treated with dilute ammonia in strong ethyl alcohol, rinsed in alcohol, chlorinated, rinsed in alcohol, stained in a 2–4% aqueous

solution of iodine-potassium iodide, and finally mounted under a cover glass in a drop of 60% sulphuric acid, dark brown crystals of iodine form within the layers of the secondary wall. These crystals aggregate in slender, elongated, crystalline complexes which vary in size and number, depending upon the duration and the intensity of the successive treatments and upon other factors. The crystals evidently originate within the elongated interstices of the cellulosic matrix and are oriented parallel to the long axis of the fibrils of cellulose. The crystals, or crystalline aggregates, are so conspicuous and so clearly visible, microscopically, that it is possible not only to detect such major variations in orientation of the cellulose as occur in passing from layer to layer of the secondary wall, but also to observe such fluctuations in orientation as occur within the limits of a single layer.

ORIENTATION OF CELLULOSE IN SECONDARY WALLS OF NORMAL CONIFEROUS TRACHEIDS

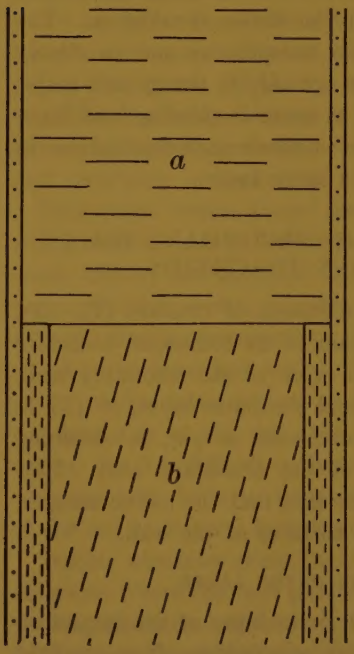
In the case of the normal 3-layered tracheids of conifers (Pl. 208, Fig. 9), it is possible, by varying the details of the technique, to induce crystals to form (1) within the central layer of the secondary wall, (2) throughout both the central layer and the outer layer, or (3) in the outer layer alone. We have not succeeded, as yet, in obtaining them within the tenuous inner layer of the secondary wall. This appears to be due, at least in part, to the fact that the iodine escapes, during the treatment, from the exposed surfaces of the wall.

A. Orientations of the outer layer

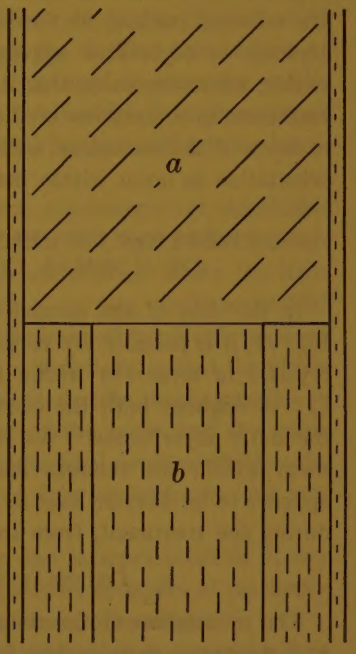
The orientation of the cellulose in the outer layer of the secondary wall fluctuates more or less from specimen to specimen, from tracheid to tracheid of the same specimen, and in different parts of the same cell. In certain samples of wood that we have sectioned, the cellulose tends to be arranged at right angles to the long axis of the cell in the unpitted parts of the earlywood tracheids (Text fig. 1a; Pl. 206, Figs. 1 and 3), and to have a helical orientation in homologous parts of the latewood tracheids (Text fig. 2a; Pl. 206, Fig. 4, and Pl. 207, Figs. 5 and 6). In other samples of wood, the arrangement may be helical in both earlywood and latewood, or it may fluctuate from tracheid to tracheid throughout the annual ring. There is no evidence to indicate that specific orientations are characteristic of particular species. On the contrary, the available data suggest that the arrangement of the cellulose fluctuates considerably in different parts of the same tree.

Local deviations in the prevailing orientation of any specific tracheid

are of common occurrence in pitted parts of the wall. Not only is there a circular arrangement of the cellulose in the embossed parts of the wall which form the borders of the pits (Text fig. 3), but there is a modified orientation in the adjacent parts of the wall as well. Such local deviations in orientation are more extensive and pronounced in large thin-walled tracheids than in small, thick-walled ones.



TEXT FIGURE 1



TEXT FIGURE 2

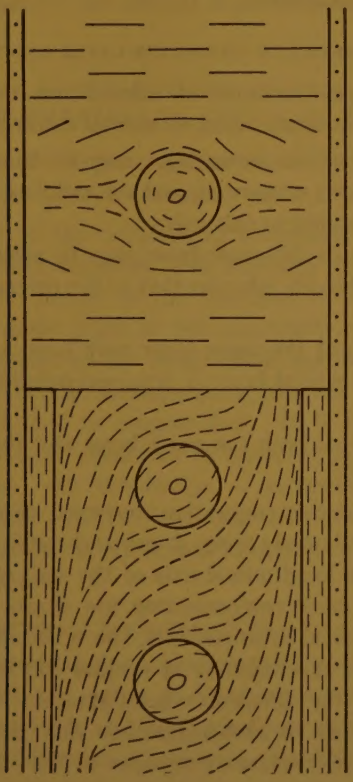
TEXT FIGURE 1. Diagrammatic illustration of the orientations of cellulose in the outer layer (a) and the central layer (b) of the unpitted tangential wall of a normal earlywood tracheid.

TEXT FIGURE 2. Diagrammatic illustration of the orientations of cellulose in the outer layer (a) and the central layer (b) of the unpitted tangential wall of a normal latewood tracheid.

B. ORIENTATIONS OF THE CENTRAL LAYER

The arrangement of the cellulose in the central layer of the secondary wall also varies more or less from specimen to specimen, from tracheid to tracheid, and in different parts of the same cell. Not infrequently the fibrils of cellulose tend to be oriented more nearly parallel to the long axis of the cell in the latewood (Text fig. 2b; Pl. 207, Fig. 5), than

in the earlywood (Text fig. 1b; Pl. 206, Fig. 3), but helical arrangements are of not uncommon occurrence in latewood, and the cellulose may, at times, be oriented parallel to the long axis of the cell in earlywood. The most striking deviations in orientation occur in pitted parts of the wall, particularly in the radial walls of the earlywood tracheids (Text fig. 3; Pl. 206, Fig. 4). The fibrils do not have a



TEXT FIGURE 3. Diagrammatic illustration of the orientations of cellulose in the outer layer and the central layer of the pitted radial wall of a normal earlywood tracheid.

circular or concentric arrangement in the embossed parts of the wall — as is the case in the outer layer of the secondary wall — but curve about and through the borders of the pits as indicated in Text fig. 3. Thus, in the earlywood, the orientation of the cellulose commonly tends to deviate more from the vertical axis in the radial walls than in the unpitted or sparsely pitted tangential walls (Text figs. 1–3).

The orientation of the fibrils may fluctuate, at times, in the successively formed growth rings or lamellae of the central layer, but pronounced shifts in orientation are of relatively infrequent occurrence in the tracheids of conifers. Regularly recurring changes from right-handed to left-handed helixes or *vice versa,* such as are hypothesized by various investigators, are rarely, if ever, encountered in the central layer of coniferous tracheids.

C. Correlations between the outer layer and the central layer

There are four combinations of orientations that are of common occurrence in the secondary walls of normal coniferous tracheids:

(1) The cellulose of the outer layer may be oriented at right angles to the longitudinal axis of the cell, and the cellulose of the central layer may be arranged parallel to this axis.

(2) The cellulose of the outer layer may be oriented at right angles to the long axis of the cell, whereas that of the central layer has a helical arrangement.

(3) The cellulose of the outer layer may have a helical orientation, whereas that of the central layer is arranged parallel to the long axis of the cell.

(4) The cellulose of both the outer layer and the central layer may be helically oriented.

It is significant in this connection, however, that the helixes of the central layer have relatively steep slopes and rarely deviate as much as 45 degrees from the longitudinal axis of the cell, whereas those of the outer layer usually have comparatively low slopes. Thus, even when both layers have helical arrangements, the orientations rarely, if ever, are parallel. In all the material of normal coniferous tracheids that we have examined, the differences in orientation in unpitted parts of the secondary wall are of such magnitude that they may be detected when very thin (5 μ) transverse sections of the cells are examined in polarized light between crossed nicols. In other words, the central layer in such sections is either isotropic (Pl. 208, Fig. 9), or detectably less birefringent than the outer layer (Pl. 208, Fig. 13). This is due, of course, to the fact that a layer is dark in transverse sections when its cellulose is oriented parallel to the long axis of the cell but attains its maximum birefringence when the cellulose is oriented at right angles to this axis.

It should be noted, in passing, that according to Frey,[1] the micelles

[1] Frey, A., Die submikroskopische Struktur der Zellmembranen (Jahrb. Wiss. Bot. 65: 195-223. 1926).

of cellulose have a circular orientation in the borders of the pits, whereas Scarth and his co-workers[1] consider that the fibrils merely curve about the bordered pits, "instead of regularly circling round them." Both investigators are right or wrong, depending upon the part of the wall which is selected for observation. As we have shown, the orientation of the outer layer is circular and thus in agreement with Frey's contention, whereas that of the central layer is entirely in accord with Scarth's view.

ORIENTATION OF CELLULOSE IN THE SECONDARY WALLS OF THE TRACHEARY CELLS OF DICOTYLEDONS

A. Normal 3-layered tracheids, fiber-tracheids, and libriform fibers

The arrangement of the cellulose in secondary walls of normal 3-layered tracheids, fiber-tracheids, and libriform fibers of dicotyledons resembles that which occurs in the tracheids of conifers. Thus, the orientation of the outer layer of the secondary wall fluctuates from positions at right angles to the longitudinal axis of the cell (Pl. 207, Fig. 6), to various helical arrangements, whereas that of the central layer varies from helical to longitudinal. It is significant, however, that with the progressive reduction of bordered pits in fiber-tracheids and libriform fibers, the orientation — particularly of the central layer — tends to show less extensive local deviations, and the arrangements of the cellulose in the radial and tangential walls are more nearly uniform and comparable.

B. Aberrant types of fiber-tracheids and libriform fibers

Deviations in the orientation of cellulose in the successively formed parts of the central layer appear to be of more frequent occurrence in thick-walled fiber-tracheids and libriform fibers of dicotyledons than in the tracheids of the latewood of conifers. Not infrequently the deviations are of such magnitude that they may be detected when thin transverse sections of the cells are viewed in polarized light between crossed nicols (Pl. 208, Fig. 10). In the so-called gelatinous fibers of dicotyledons, there are abrupt transitions from concentric to radial or radio-concentric structural patterns and *vice versa*. These abrupt changes in the structural pattern of the cellulosic matrix may or may not involve concomitant modifications in the orientation of the cellulose in relation to the longitudinal axis of the cell.

[1]Scarth, G. W., R. D. Gibbs, & J. D. Spier. The structure of the cell wall and the local distribution of the chemical constituents (Trans. Roy. Soc. Canada 5: 269-279. 1929).

C. Vessels

In the less specialized types of dicotyledonous woods, the vessel members resemble tracheids in size, form, and structure. They tend to be comparatively thin-walled, and to have secondary walls which are conspicuously 3-layered, except in heavily pitted parts where the vessel members of the same or of different vessels are in contact. The arrangement of the cellulose in such 3-layered secondary walls of vessels (Pl. 208, Fig. 11), fluctuates much as it does in normal tracheids. Thus, the outer layer may have an orientation at right angles to the long axis of the cell, or it may have a helical arrangement of comparatively low slope. As in the case of normal tracheids, the central layer has an orientation which is either parallel to the long axis of the cell or steeply helical.

As the vessels of dicotyledons become more and more highly specialized, they tend to form secondary walls of a wider range of structural complexity and diversity. Not infrequently, they tend to lose their typical 3-layered structure and to form multi-layered walls or thick walls which are more or less birefringent throughout (Pl. 208, Fig. 14), when transverse sections are viewed in polarized light between crossed nicols. In other words, the orientation of the cellulose in the more highly specialized types of dicotyledonous vessels frequently deviates markedly from that which occurs in normal tracheids.

It should be emphasized, in this connection, that variations in the thickness of the secondary walls of normal 3-layered tracheids are due primarily to variations in the width of the central layer (Pl. 208, Fig. 9), — i. e., of a layer which is dark or feebly birefringent in transverse sections. On the contrary, fluctuations in thickness of the secondary wall of vessels commonly are due to variations in the width of layers which are intensely birefringent (Pl. 208, Figs. 12 and 14), when transverse sections are examined in polarized light between the crossed nicols. Thus, the more conspicuous differences between the secondary walls of tracheids and of specialized types of vessel members are due primarily to different orientations of cellulose in the successively formed parts of the secondary wall.

DISCUSSION

The secondary wall of tracheary cells and fibers is composed of a continuous and firmly coherent matrix of anastomosing fibrils of cellulose. Lignin and other non-cellulosic substances may be deposited in the elongated, intercommunicating interstices of this matrix, thus resulting

in two continuous interpenetrating systems of different chemical composition. The threadlike parts of the two interpenetrating systems have parallel orientations. Therefore, the crystals of iodine which form within the elongated interstices of the cellulosic matrix after chlorination are oriented parallel to the long axis of the fibrils of cellulose. That such is indeed the case may be demonstrated by various corroborative lines of evidence.

(1) Where aggregations of fibrils or so-called striations are clearly visible in surface views of unswollen secondary walls, the crystalline aggregates of iodine are oriented parallel to the long axes of these structures.

(2) In the case of thick secondary walls of the 3-layered type — where the slitlike pit orifices are oriented parallel to the fibrillar axis of the central layer — the crystals of the central layer are arranged parallel to the slitlike orifices of the pits.

(3) In secondary walls having a pronounced radio-longitudinal or radio-helical structural pattern — where mechanical cleavages and seasoning cracks are oriented longitudinally or radio-helically — the crystals of iodine are arranged parallel to the cleavage planes and seasoning cracks.

(4) In favorable material — where the angles of extinction and dichroic phenomena in polarized light are clearly visible and can be accurately measured — the orientation of the cellulose as determined by the crystal method is in close agreement with the data obtained by polarization techniques. In fact, the evidence secured by the crystal and polarization techniques is so strikingly complementary that our photographs of crystal orientations might be substituted for Frey's diagrams of micellar arrangements in homologous layers.

The crystal method is so significant in studying the details of fibrillar orientation in different parts of a single wall or layer that it is of interest to determine whether the technique may be modified for use in the study of unlignified secondary walls. This has been attempted by Doctor Thomas Kerr, who has succeeded in inducing crystals of iodine to form within the wall of the cotton hair. His modification of our technique consists in staining the secondary wall of the cotton hair with iodine-potassium iodide or with chloroiodide of zinc, and subsequently treating the stained preparation with a syrupy, "supersaturated" solution of zinc chloride. Thus, it is evident that the crystal method may be modified for the study of both lignified and unlignified secondary walls.

CONCLUSIONS

1. Crystalline aggregates of iodine may be induced to form within the elongated interstices of the cellulosic matrix of the secondary wall. These elongated crystals are oriented parallel to the long axis of the fibrils of cellulose and therefore of the micelles and chain molecules.

2. The crystalline aggregates are so conspicuous and so clearly visible, microscopically, that it is possible not only to detect such major variations in orientation of the cellulose as occur in passing from layer to layer of the secondary wall, but also to observe such fluctuations in orientation as occur within the limits of a single layer.

3. In the case of normal, 3-layered tracheids, fiber-tracheids, and libriform fibers, the orientation of the cellulose in the outer layer and in the central layer of the secondary wall fluctuates more or less from specimen to specimen, from cell to cell, and in different parts of the same cell.

4. Although the orientation of the cellulose may deviate, at times, in the successively formed growth rings or lamellae of the central layer, there is no regular alternation of right-handed and left-handed helixes as hypothesized by various investigators.

5. In the case of the large bordered pits of the earlywood of conifers, the cellulose has a circular orientation in the outer layer, but merely curves about the pits in the central layer.

6. The less specialized types of dicotyledonous vessels resemble normal tracheids in having a 3-layered secondary wall, whereas the more highly specialized types have walls of a much wider range of complexity and structural variability, owing to fluctuations in the orientation of the cellulose.

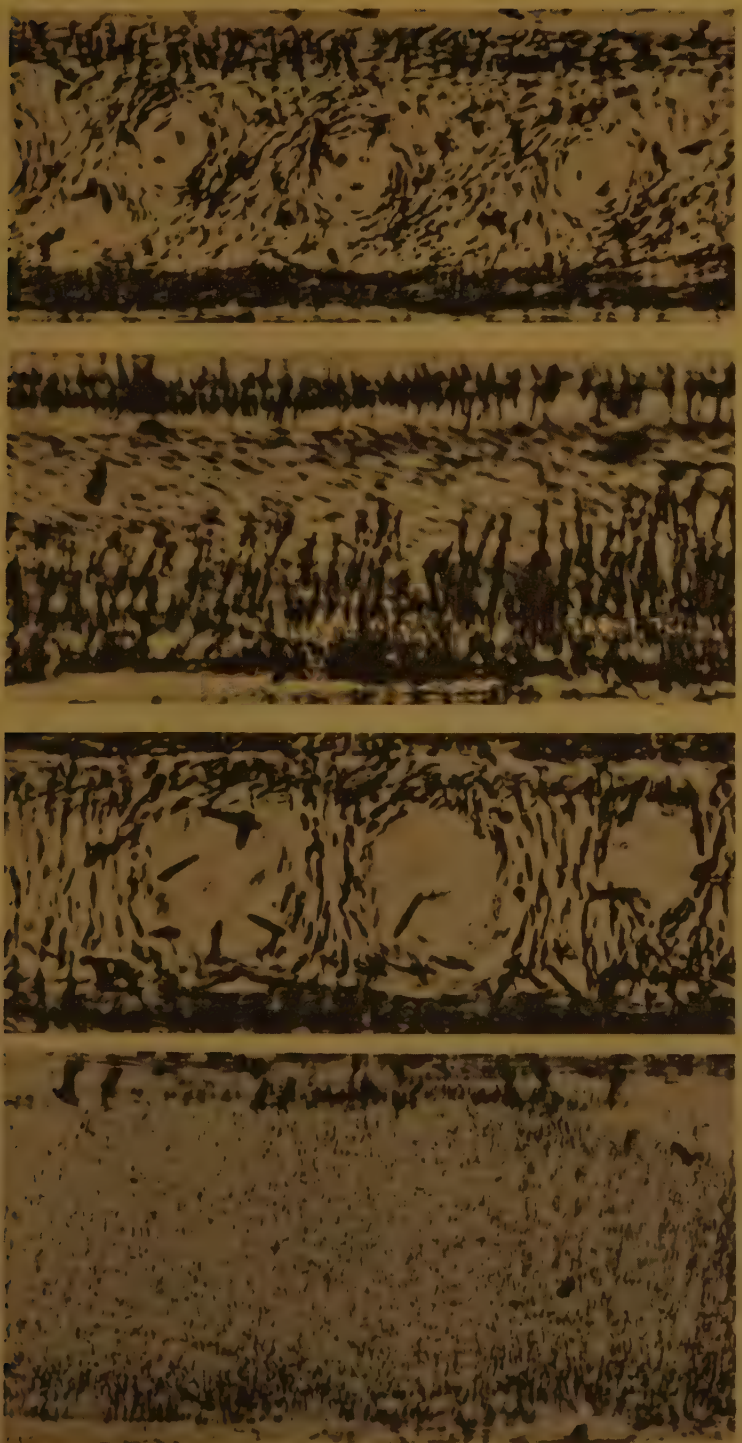
DESCRIPTION OF PLATES

PLATE 206

Fig. 1. *Sequoia sempervirens* Endl. Unpitted radial wall of earlywood tracheid, showing, in the outer layer, numerous minute crystals oriented at right angles to the long axis of the cell. × 750.

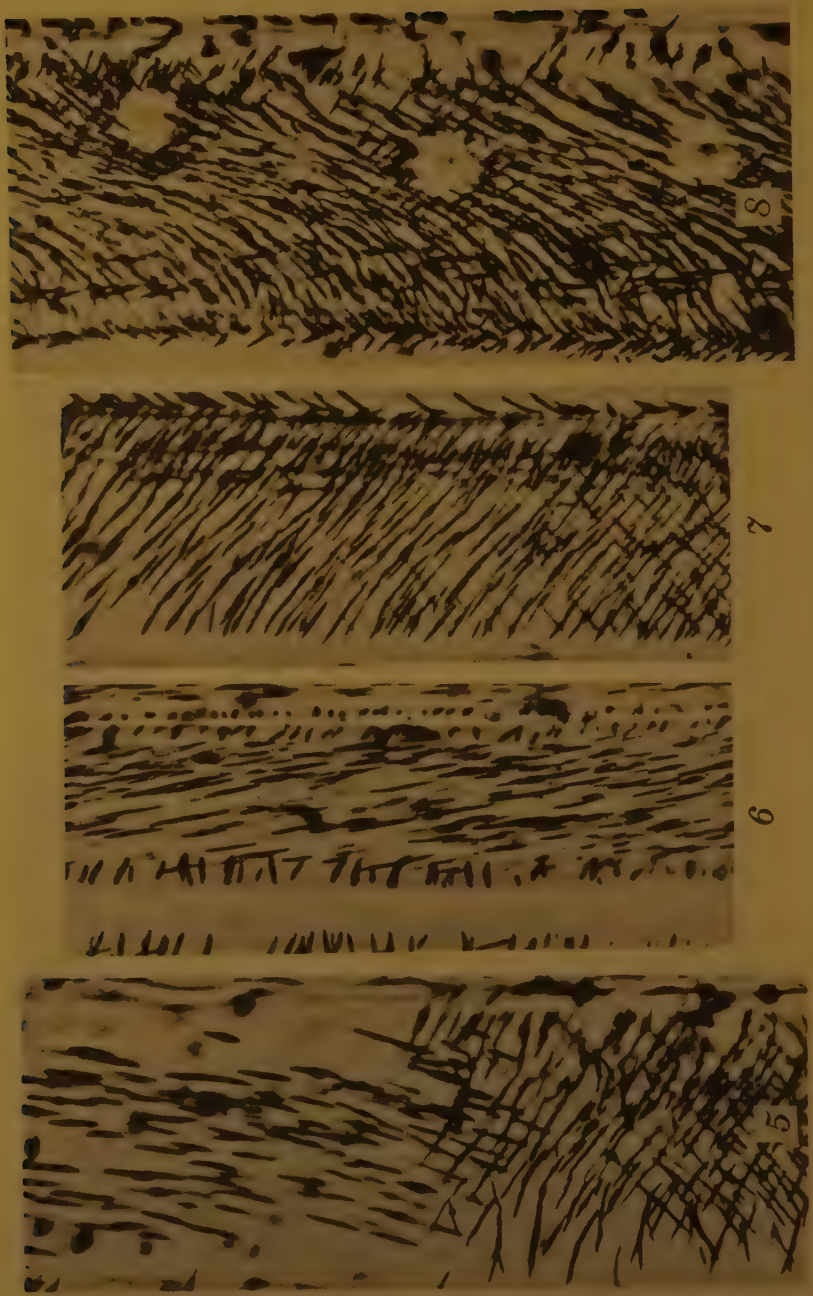
Fig. 2. *Sequoia sempervirens.* Pitted radial wall of earlywood tracheid, showing, in the outer layer, coarser crystalline aggregates oriented at right angles to the long axis of the cell except in proximity to the bordered pits. The larger irregularly oriented crystals are lying upon the exposed inner surface of the wall. × 750.

Fig. 3. *Sequoia sempervirens.* Earlywood tracheid from which part of the outer layer has been cut away (right), showing transverse orientation of crystals in the outer layer of the secondary wall (left) and steeply helical arrangement in the central layer (right). × 1000.

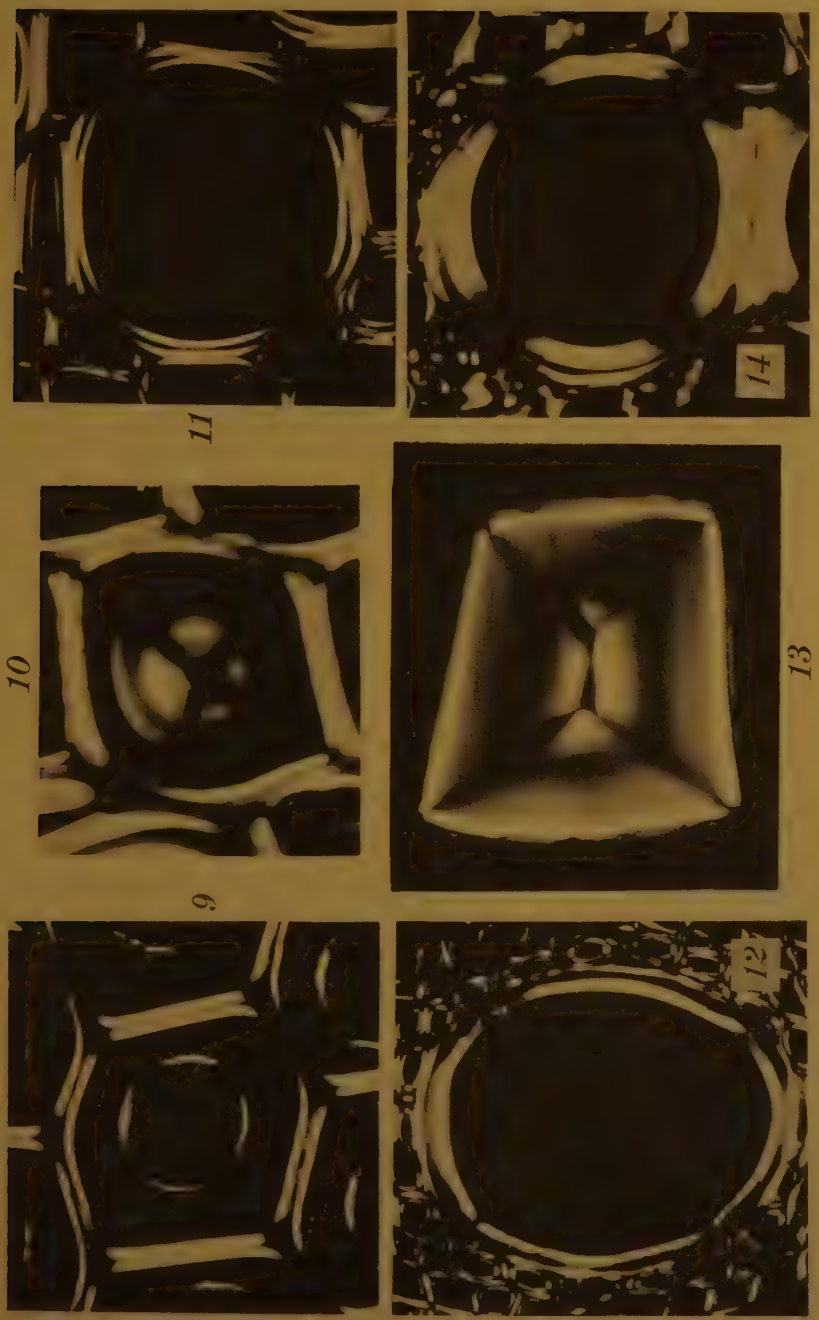


ORIENTATION OF CELLULOSE

FULL-TONE — MERIDEN



ORIENTATION OF CELLULOSE



ORIENTATION OF CELLULOSE

Fig. 4. *Pinus Strobus* L. Pitted radial wall of earlywood tracheid, showing deviations in the helical arrangement of crystals in the central layer due to the presence of bordered pits. × 750 (compare with Text fig. 3.)

PLATE 207

Fig. 5. *Larix occidentalis* Nutt. Unpitted tangential walls of latewood tracheids, showing helical orientations of crystals in the outer layers of two adjacent superimposed cells (lower half of figure), and approximately longitudinal arrangement of crystals in a central layer (upper half of figure). × 900.

Fig. 6. *Trochodendron aralioides* Sieb. & Zucc. Longitudinal section of the secondary wall of a latewood tracheid, showing approximately transverse orientation of crystals in the outer layer and steeply helical orientation of crystals in the central layer. The central layer is seen in surface view, the outer layer in sectional view. × 750.

Fig. 7. *Larix occidentalis.* Tangential wall of latewood tracheid, showing helical orientation of crystalline aggregates in the outer layer. A few helically arranged crystals of an adjacent outer layer are visible in the lower half of the figure. × 750.

Fig. 8. *Larix occidentalis.* Tangential wall of a latewood tracheid, showing deviations in the helical orientation of crystalline aggregates in the outer layer due to the presence of bordered pits. × 900.

PLATE 208

All the figures illustrated in this plate were photographed in polarized light between crossed nicols.

Fig. 9. *Pinus longifolia* Roxb. Transverse section of the latewood, showing one entire tracheid and parts of six others. The narrow inner and outer layers of the secondary wall are intensely birefringent, whereas the broad central layer is dark. × 800.

Fig. 10. *Myodocarpus simplicifolius* Brong. & Gris. Transverse section of a thick-walled fiber-tracheid, showing internal birefringent layers of the secondary wall. × 1300.

Fig. 11. *Myodocarpus simplicifolius.* Transverse section of a relatively primitive type of vessel, showing typical 3-layered secondary wall. × 550.

Fig. 12. *Lithocarpus edulis* (Mak.) Rehd. Transverse section of a more specialized type of vessel, showing broad birefringent inner layer of the secondary wall. × 300.

Fig. 13. *Sequoia sempervirens.* Transverse section of a fiber, showing broad central layer of varying birefringence. × 1200.

Fig. 14. *Fraxinus mandshurica* Rupr. Transverse section of a highly specialized type of vessel, showing intensely birefringent secondary wall. × 550.

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THE SIGNIFICANCE OF CERTAIN WOOD-DESTROYING FUNGI IN THE STUDY OF THE ENZYMATIC HYDROLYSIS OF CELLULOSE

I. W. BAILEY AND MARY R. VESTAL

With plates 209 and 210 and three text figures

INTRODUCTION

IN 1913, one of us[1] called attention to certain wood-destroying fungi which produce helically oriented cavities within the thick secondary walls of the latewood of *Pinus Taeda* L. Subsequently, in studying the comparative anatomy of a wide range of conifers, monocotyledons, and dicotyledons, we have encountered similar fungi, not only in the wood of many different species, genera and families of the higher plants, but also in material from diverse temperate and tropical environments. The fungi evidently are ubiquitous forms which attack the woody tissues of the gymnosperms and of the angiosperms when these tissues are cut and are exposed to the air.

The fungi are characterized by the facts (1) that at least a part of their hyphae move forward within the secondary wall and (2) that their enzymes dissolve cavities which are oriented either helically or parallel to the long axis of the cell. The arrangement of the enzymatically-produced cavities suggests that hydrolysis proceeds along planes that are determined by the structural orientation of the cellulose, and, therefore, that such fungi may afford a means of securing significant information regarding predetermined planes of chemical reaction in the cellulosic matrix of the secondary wall. The results of a reconnaissance of woods that have been attacked by these fungi[2] are recorded in the following pages.

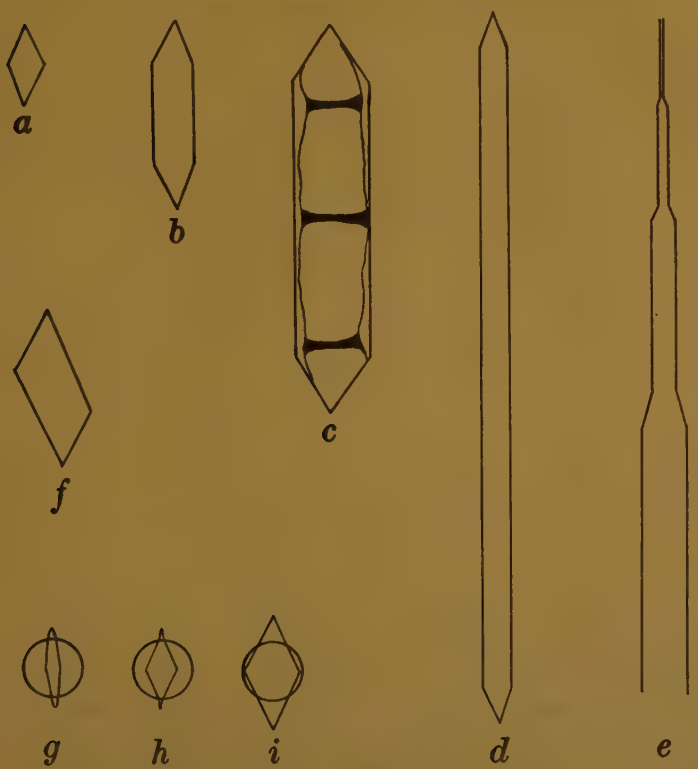
FORM AND DEVELOPMENT OF THE ENZYMATICALLY-PRODUCED CAVITIES

During their stages of elongation, the hyphae are extremely tenuous filaments which dissolve correspondingly minute, elongated cavities

[1] BAILEY, I. W., The preservative treatment of wood. I. The validity of certain theories concerning the penetration of gases and preservatives into wood (Forestry Quarterly 11: 5-11. 1913).

[2] We have found these fungi in 114 species, 88 genera, and 36 families of the gymnosperms and angiosperms.

within the secondary wall (Text fig. 3). These slender, cylindrical perforations subsequently are enlarged by further enzymatic activity (Pl. 209, Figs. 1, 2, 6 and 7) which may continue until much of the secondary wall is dissolved (Pl. 209, Fig. 3). The process of lateral

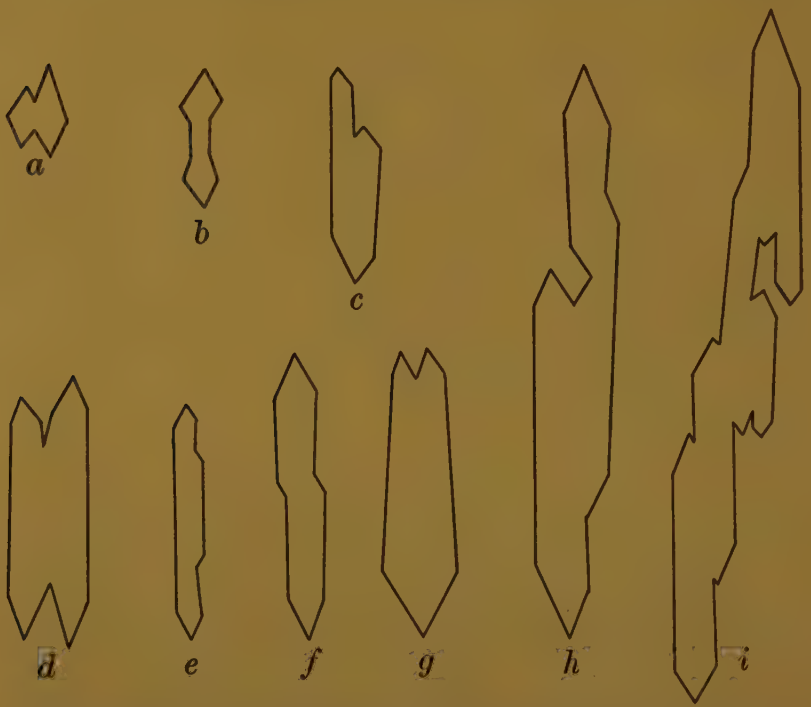


TEXT FIGURE 1. Enzymatically-produced cavities as seen in median longitudinal planes of optical section. (a) Biconical cavity. (b), (c) and (d) Cylindrical cavities with conical ends, (c) containing remains of dilated hypha. (e) Progressive stages in the enlargement of a slender cylindrical perforation. (f) Cavity produced by the lateral fusion of two biconical cavities. (g), (h) and (i) Successive stages in the enlargement of a pit orifice.

enlargement rarely progresses uniformly throughout the length of the cylindrical cavities, but tends to be accelerated in certain parts and to be retarded in others. Thus, as indicated in Pl. 210, Figs. 8–13, localized enzymatic activity produces more or less numerous dilations which are

oriented in a linear series and are connected by unaltered or less modified parts of the original elongated perforation.

Although the chambers vary considerably in size, they obviously are restricted to two principal geometric forms (1) biconical or (2) cylindrical with conical ends. In perfectly median longitudinal sections, the former cavities have a diamond-shaped outline (Pl. 210, Figs.

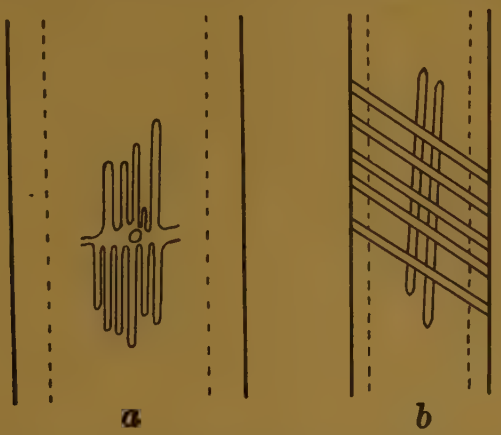


TEXT FIGURE 2. Complex types of cavities resulting from the fusion of primary forms.

8, 10 and 11), whereas the latter have parallel sides and terminate in acute angles (Pl. 210, Figs. 9 and 13; Text fig. 1, b, c and d). Of course, the outlines deviate considerably in other planes of section (Pl. 210, Fig. 12) and many complex forms arise during the fusion of cavities, either of the same linear series (Text figs. 1, e and 2, b) or of adjacent series (Text figs. 1, f and 2, a, c-i).

Such facts as these suggest that hydrolysis of the cellulose through enzymatic activity proceeds along two clearly defined sets of planes. During elongation of the tenuous hyphae, *terminal* enzymatic activity

progresses primarily along one of the sets of planes producing attenuated, cylindrical perforations, whereas subsequent *lateral* enzymatic activity develops along either or both of these sets of planes and produces biconical cavities or cylindrical chambers with conspicuously conical ends.



TEXT FIGURE 3. (a) Early stage of the growth of hyphae within the central layer of the secondary wall. (b) Helically oriented perforations in the outer layer of the secondary wall in contrast to the more nearly vertical arrangement in the central layer.

ORIENTATION OF THE PLANES OF ENZYMATIC HYDROLYSIS

As a result of varied optical and physico-chemical investigations, it is now generally recognized that, in the case of tracheids and fibers, the chain molecules of cellulose are oriented approximately parallel to the long axis of the anastomosing fibrils which constitute the secondary wall. That the long axis of the hyphal filaments and of the cylindrical perforations is oriented parallel to that of the fibrils and, therefore, to that of the chain molecules or micelles, may be demonstrated by various lines of evidence. (1) Where the fibrillar structure of the secondary wall is clearly visible, as is sometimes the case, it may be observed that the hyphae and the linear series of cavities are oriented parallel to the long axis of the fibrils. (2) In thick-walled tracheids, fiber-tracheids, and libriform fibers of the normal 3-layered type, the slitlike orifices of the pits are oriented parallel to the fibrils of the broad central layer of the secondary wall. Since most of the enzymatically-produced cavities are confined to this layer (Pl. 209, Figs. 1 and 2) the pit orifices afford a

reliable means of correlating the orientations of the fibrils and of the cylindrical perforations within the central layer of the secondary wall. (3) In thin, 5 μ, longitudinal sections of favorable material, it may be demonstrated that the positions of extinction of the cellulose in polarized light are oriented parallel to the sides of the cylindrical cavities. (4) When sections of lignified secondary walls are chlorinated, treated with an aqueous solution of iodine-potassium iodide, and subsequently with a drop of 60% sulphuric acid, dark brown crystals of iodine form within the elongated interstices of the cellulosic matrix. These elongated crystals, or crystalline aggregates, are visible microscopically and are oriented parallel to the long axis of the fibrils. By means of these crystals, it is possible not only to detect such major variations in the structural orientation of cellulose as occur in passing from layer to layer of the secondary wall, but also to observe such minor fluctuations in orientation as occur within the limits of a single layer. As shown in Pl. 209, Fig. 5, the linear series of cavities and the sides of the individual cylindrical chambers are oriented parallel to the long axis of the crystals, and therefore of the fibrils and chain molecules.

These and other lines of corroborative evidence indicate that the hyphae, the cylindrical perforations, and the linear series of enzymatically-produced cavities are oriented parallel to the long axis of the cellulosic fibrils. Where the chain molecules, the micelles, and the fibrils are helically oriented, the hyphae and the cavities have a helical arrangement (Pl. 210, Figs. 12 and 13) and where they are oriented more nearly parallel to the long axis of the cell, the hyphae and the perforations have a similar arrangement (Pl. 210, Figs. 8, 9 and 10). Furthermore, where the orientation of the cellulose changes in different parts of the secondary wall, the arrangement of the hyphae and of the enzymatically-produced cavities fluctuates accordingly (Text fig. 3, b). In other words, one set of the predetermined planes of enzymatic activity is oriented parallel to the long axis of the fibrils, and, therefore, of the chain molecules of cellulose. The second set of planes obviously is oriented at an acute angle to this axis, and it is essential to measure the angle and to determine, if possible, whether it is variable or constant.

Unfortunately, there are inherent optical and other difficulties to be overcome in measuring this angle with consistent accuracy. In the first place, there is the difficulty of turning the lines of the eyepiece into exact coincidence with the two legs of the angle to be measured. The smaller the cavity, the greater this source of error becomes. In the second place, there is considerable uncertainty in determining whether a particular cavity is being viewed in a truly median longitudinal plane of optical section. This difficulty is accentuated by the fact that, in

the case of helically oriented structures, the chambers are curved, and furthermore by the fact that many of the larger cavities are not truly cylindrical or biconical, i. e., they are not perfectly circular in transverse sections (Pl. 209, Figs. 1, 2 and 6). Another common source of error, particularly in dealing with the larger cavities, is local deviations in the orientation of the cellulose, which lead to the formation of asymmetrical cavities. It is significant, in addition, that the critical angles become smaller when the wall contracts, e. g., in drying, and enlarge when the the wall swells. Thus, the angles may be modified during the processes of drying, and subsequently of resoaking, softening, and dehydrating the material for microscopic examination.

The measurements recorded in Table 1 were obtained from nine species and genera of seven different families, including one gymnosperm. Although the individual measurements for particular species, and the averages for different species, fluctuate through a range of variation of from 5 to 6 degrees, it is reasonable to assume that many of these variations are due to inherent difficulties in accurately measuring the angles of intersection of the two sets of planes. Thus, there appear to be two predetermined sets of planes of enzymatic activity in the secondary walls of tracheary cells and fibers, (1) oriented parallel to the long axis of the chain molecules and fibrils and (2) oriented at an angle of from 20–25 degrees to this axis.

TABLE 1

MEASUREMENTS OF THE ANGLE OF INTERSECTION OF THE TWO PRINCIPAL PLANES OF ENZYMATIC ACTIVITY

Plant	Min.	Av.	Max.
Ilex formosana Maxim.	15.0	19.5	21.8
Myodocarpus fraxinifolius Brongn. & Gris.	16.9	19.5	22.1
Iryanthera macrophylla (Benth.) Warb.	18.9	20.5	21.8
Laurelia aromatica Juss.	18.3	22.7	24.3
Adinandra sp.	21.0	22.8	24.9
Cussonia Barteri Seem.	19.9	23.2	26.0
Osteophloeum platyspermum (A. DC.) Warb.	20.3	23.2	25.6
Pinus echinata Mill.	18.8	23.7	27.5
Brackenridgea Hookeri A. Gray	22.9	25.6	28.1
	Average	22.3	

Basis of individual averages, 20 measurements.

The second set of planes is not correlated with any visible structures of the cellulosic matrix and, therefore, is determined by submicroscopic ones. The fact that the orientation of these planes is modified during

the swelling of the secondary wall, — i. e., where the spacing of the glucose residues is altered — suggests that these planes of hydrolysis are determined by specific configurations in the unit cell of cellulose.

It is possible to isolate fibers that have been attacked by these fungi, and subsequently to treat them with reagents — e. g., sulphuric acid, phosphoric acid or cuprammonium hydroxide — which dissect the wall into "fusiform bodies"[1] and other minute anisotropic fragments. By observing the phenomena in close proximity to the enzymatically-produced cavities, it may be observed that the fusiform bodies are dissected from the wall along planes that are parallel to those of these cavities. In other words, the chemical changes induced by these inorganic reagents progress along planes that are oriented parallel to the predetermined planes of enzymatic activity. As the fusiform bodies are cut free from the wall, they tend to be more or less rapidly deformed by the swelling effects of the reagents used in their production. When the walls themselves are swollen during the treatment — i. e., where the spacing of the chain molecules is altered — the angles between the two intersecting sets of planes are increased, and the shape of the enzymatically-produced cavities becomes correspondingly modified. Under such circumstances, the original cavities contract longitudinally and expand laterally. Thus, the orientation of the oblique surfaces is gradually modified.

The illustrations of partially acetylated fibers published by Hess,[2] Kanamaru,[3] and others indicate that acetylation of cellulose tends to proceed along similar planes, i. e., planes parallel to the long axis of the chain molecules or fibrils, and planes set at an acute angle to this axis. A careful study of these planes of chemical action during hydrolysis and acetylation should yield significant data regarding the submicroscopic configurations of cellulose.

MISCELLANEOUS DATA CONCERNING THE FUNGI AND THEIR HYPHAE

In view of the fact that we have not succeeded in finding any descriptions of these fungi in the literature or information concerning their identity, it seems advisable to record the following data regarding them, even though our observations, thus far, are based solely upon the study of sections of thoroughly seasoned tissues. There are two types of hyphae in a majority of the specimens that we have examined (1) delicate, colorless filaments and (2) coarse, dark brown hyphae which con-

[1] RITTER, J. Dissection of wood fibrils by chemical means. (Ind. Eng. Chem. 21: 289. 1929.)

[2] HESS, K. Die Chemie der Zellulose und ihrer Begleiter. Leipzig. 1928.

[3] KANAMARU, K. Die Brechungsindices von Nitrocellulose und Acetylcellulose. (Helv. Chem. Acta 17: 1429-1440. 1934.)

nect with them. Both types of hyphae are septate, and both are devoid of obvious clamp-connections. The abundance and distribution of the hyphae vary greatly from specimen to specimen. In certain cases, the colored hyphae are confined largely to the lumina of the rays and wood parenchyma — as is true for the "blue stain" fungus — whereas in others they occur chiefly in the lumina of the vessels, fiber-tracheids or libriform fibers. The colorless hyphae perforate the secondary walls and move forward within them. As the enzymatically-produced cavities enlarge, the hyphae tend to become more or less conspicuously dilated (Text fig. 1, c) and, in dried material, frequently are encrusted both internally and externally with a granular substance which stains deeply with Haidenhain's haematoxylin (Pl. 209, Figs. 1, 2, 4 and 6).

The hyphae which move forward within the secondary wall usually attack the walls of the tracheids, fiber-tracheids or libriform fibers, and occasionally of the vessels, but rarely, if ever, of ray parenchyma or of wood parenchyma. Furthermore, they tend to develop primarily within the central layer of the secondary wall (Pl. 209, Figs. 1, 2 and 6); although in the case of certain specimens, they may perforate the outer layer as well (Text fig. 3, b). As indicated in (Pl. 209, Fig. 3), the fungi frequently dissolve the central layer of the secondary wall, leaving the inner and the outer layers intact. Such facts as these suggest that the enzymatic activity may be retarded or inhibited in walls and layers which are very intensely lignified.

In a few of the specimens, which have abundant hyphae within the lumina of the fiber-tracheids, and few, if any, hyphae within the secondary wall, the enzymes attack the inner surface of the wall, and the hydrolysis progresses centrifugally through the central layer. Although this type of enzymatic activity produces less obviously symmetrical cavities, it tends to proceed along two clearly defined sets of planes, i. e., parallel to the long axis of the fibrils and at an angle of 20–25 degrees to this axis. The latter planes of enzymatic hydrolysis are most clearly visible in walls where the orifices of the bordered pits are undergoing enlargement (Text fig. 1, g, h, i).

It should be emphasized, in conclusion, that these fungi are so significant from experimental and physico-chemical points of view that an effort should be made to isolate them, to grow them in pure cultures, and to obtain reliable information concerning their identity.

Since completing the manuscript for this paper, we have examined one of Dr. D. H. Linder's specimens of the wood of *Acer rubrum* L. which has been attacked by a species of *Brachysporium*. The hyphae of this fungus dissolve helically oriented cavities of the same geo-

metrical forms as have been described in this paper. Dr. Linder is of the opinion, after examining our slides, that we are concerned with Pyrenomycetes or with the imperfect stages of this group.

CONCLUSION

1. There are certain fungi whose hyphae perforate and move forward within the secondary walls of tracheary cells and fibers.

2. The cavities produced by these fungi are of two geometrical forms, i. e., (1) cylindrical with conical ends or (2) biconical, and are of remarkably constant angularity, regardless of the particular group of gymnosperms or angiosperms in which they occur.

3. It is evident that the enzymatic activity of these fungi progresses along two predetermined sets of planes, (1) oriented parallel to the long axis of the fibrils and chain molecules of cellulose and (2) at an angle of from 20–25 degrees to this axis.

4. These fungi evidently are ubiquitous forms which attack the vascular and fibrous tissues of the higher plants when they are cut and are exposed to the air.

5. The fungi are so significant from experimental and physicochemical points of view that an effort should be made to isolate them, to grow them in pure cultures, and to determine their identity.

DESCRIPTION OF PLATES

PLATE 209

Fig. 1. *Poraqueiba sericea* Tul. Transverse section of the xylem, showing cavities in the central layer of the secondary wall. × 1470.

Fig. 2. *Stemonurus secundiflorus* Blume. Transverse section of the xylem, showing cavities in the secondary wall. × 580.

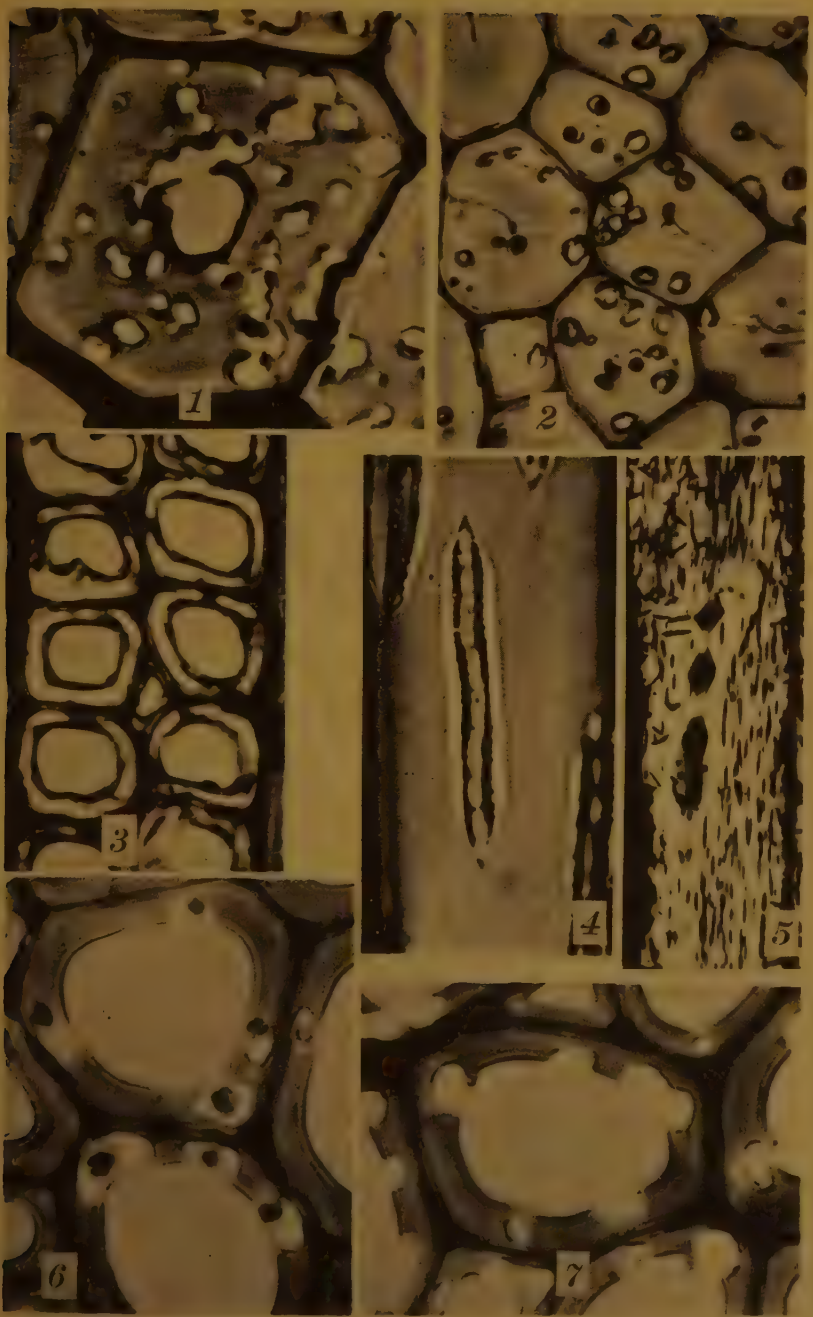
Fig. 3. *Compsoneura capitellata* (Poepp.) Warb. Transverse section of the xylem, showing an advanced stage of the decay. The central layer of the secondary wall is being removed, leaving the more heavily lignified inner and outer layers. × 760.

Fig. 4. *Iryanthera macrophylla* (Benth.) Warb. Longitudinal section of the xylem, showing enzymatically-produced cavity in the secondary wall and hypha encrusted with a deeply stainable substance. × 1470.

Fig. 5. *Brackenridgea Hookeri* A. Gray. Longitudinal section of the xylem, showing orientation of enzymatically-produced cavities and of crystalline complexes of iodine. × 760.

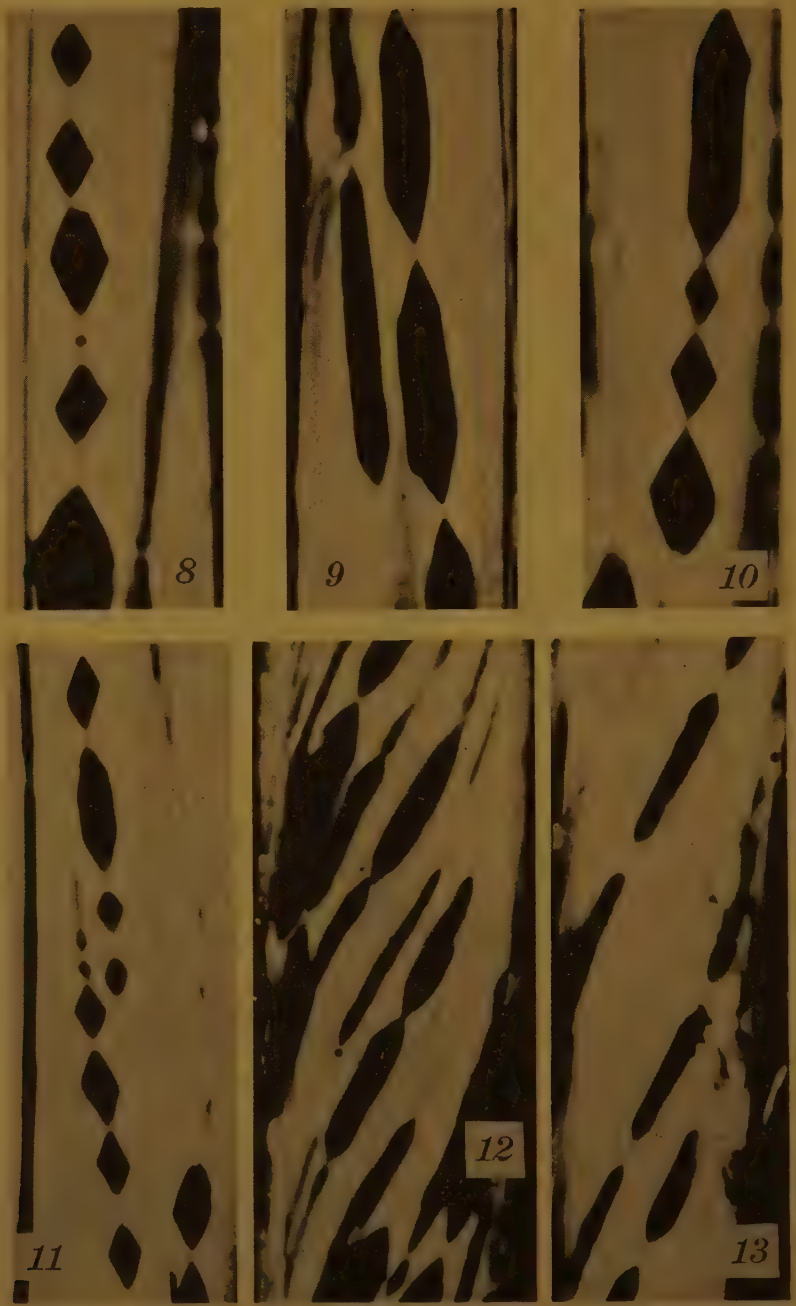
Fig. 6. *Laurelia aromatica* Juss. Transverse section of the xylem, showing hyphae and enzymatically-produced cavities in the secondary wall. × 1470.

Fig. 7. *Davidia involucrata* Baill. Transverse section of the xylem, showing cavities in the secondary wall. × 1470.



WOOD-DESTROYING FUNGI

FULL-TONE — MERIDEN



WOOD-DESTROYING FUNGI

PLATE 210

Fig. 8. *Brackenridgea Hookeri.* Longitudinal section of the xylem, photographed in polarized light between crossed nicols, showing enzymatically-produced cavities. × 990.

Fig. 9. *Laurelia aromatica.* Longitudinal section of the xylem, showing cavities in the secondary wall. × 990.

Figs. 10 and 11. *Brackenridgea Hookeri.* Longitudinal section of the xylem, showing cavities in the secondary wall. × 990.

Fig. 12. *Pinus rigida* var. *serotina* (Michx.) Loudon. Longitudinal section of the xylem, showing helical orientation of enzymatically-produced cavities in the secondary wall. × 300.

Fig. 13. *Osteophloeum platyspermum* (A. DC.) Warb. Longitudinal section of the xylem, showing helical orientation of cavities in the secondary wall. × 990.

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NOTES ON THE LIGNEOUS PLANTS DESCRIBED BY H. LEVEILLE FROM EASTERN ASIA[1]

ALFRED REHDER

LEGUMINOSAE[2]

Crotalaria Mairei Léveillé in Bull. Géog. Bot. **25**: 49 (1915); Cat. Pl. Yun-Nan, 153 (1916).

Suffrutex caulibus 10–30 cm. longis plerisque basi prostratis ascendentibus dense adpresseque sericeo-hirsutulis. Folia obovata vel obovato-oblonga, rarius oblanceolata, 1.5–2.5 cm. longa et 5–10 mm. lata, apice rotundata mucronulata, interdum acutiuscula, rarius leviter emarginata, basi cuneata in petiolum brevem 1–3 mm. longum attenuata, supra minute verruculosa, cinereo-viridia, pilis adpressis paucis conspersa, subtus dense adpresse albo-sericea (in sicco fulva), costa supra leviter vel vix impressa subtus leviter elevata; stipulae nullae vel minutae, subulatae. Flores in racemis plurifloris ad 4 cm. longis vel paucifloris subcapitatis, axi pedicellis bracteis bracteolis calyceque dense sericeo-hirsutis, bracteis subulatis pedicellos 2–3 mm. longos valde superantibus, bracteolis ad apicem petioli inserti subulatis circiter 5 mm. longis; calyx fere ad basin bilabiatus, 10–12 mm. longus, labio superiore quarta parte inferiore excepta in lobos 2 lanceolatos fisso, labio inferiore in lobos 3 anguste lanceolatos alte fisso, quarta vel tertia parte inferiore ventricosa excepta; corolla intense coerulea vel violacea, calycem subaequans, vexillo suborbiculari 11 mm. longo et lato basi rotundato supra unguem brevem prominenter bicalloso, alis oblongis vexillo paullo brevioribus, infra medium ad laterem corrugosis, carina curvata 8–9 mm. longa breviter rostrata; stamina antheris partim oblongis 1.25 mm. longis partim ovalibus 0.5 mm. longis, filamentis tantum basi quarta vel tertia parte connatis; ovarium oblongum, glabrum, 14–16-ovulatum: legumen calycem paullulo superans, ovoideo-oblongum, sessile, 10–12 mm. longum, 5 mm. diam., apice in rostrum curvatum contractum; semina circiter 4, reniformia, 2.5 mm. diam., brunnea, lucida.

[1]Continued from Vol. **18**: 26-53; for preceding parts see Vols. **10**: 108-132, 164-196; **12**: 275-281; **13**: 299-332; **14**: 223-252; **15**: 1-27, 89-117, 267-326; **16**: 311-340; **17**: 53-82, 316-340.

[2]See Vol. **13**: 321.

China. Yunnan: pâtures des mont. à Lan-ngi-tsin, alt. 3100 m., "plante vivace, fl. bleu de Prusse;" coteaux arides calcaires à Ta-kiao, rare, alt. 2550 m., "fl. bleues, feuilles gris en dessus, blanches veloutées en dessous;" pâturages de collines à Tche-hai "plante vivace en touffes rampantes, fl. violet sombre;" *E. E. Maire,* July to August 1912 (syntypes; photos. of specimens from Lan-ngi-tsin and Ta-kiao in A. A.).

I have not been able to identify *C. Mairei* with any described species from Yunnan. It belongs to Sect. Calycinae Benth. and to the species with included pod. It seems near *C. occulta* Grah. and *C. chinensis* L., but is easily distinguished from both by the smaller generally obovate and obtuse leaves densely strigose-silky beneath, and from the latter also by the dark blue or violet flowers; from *C. yunnanensis* Franch. it is distinguished also by the shape and pubescence of the stem and the larger dark blue flowers.

Sophora spec.

Milletia Esquirolii Léveillé, Fl. Kouy-Tchéou, 239 (1914). — Rehder in Jour. Arnold Arb. **13**: 326 (1932).

China. Kweichou: Ouang-mou, *J. Esquirol,* no. 106, June 1904, "fleur blanc" (holotype of *Millettia Esquirolii;* photo. in A. A.).

As far as one can judge from the meagre and fragmentary material the specimen cited above belongs to *Sophora.*

Indigofera Esquirolii Léveillé. — Rehder in Jour. Arnold Arb. **13**: 324 (1932). — Handel-Mazzetti, Symb. Sin. **7**: 547 (1933).

Handel-Mazzetti cites also a specimen of his collection (no. 6251) from Yunnan which he states differs only in its pink flowers.

Desmodium Esquirolii Léveillé, Fl. Kouy-Tchéou, 232 (1914); Cat. Pl. Yun-Nan, 154 (1916).

Desmodium cinerascens Franchet, Pl. Delavay, 174 (1890). — Rehder in Jour. Arnold Arb. **13**: 327 (1932). — Non A. Gray (1853).

Desmodium Franchetii Rehder in Jour. Arnold Arb. **3**: 41 (1921).

China. — Vide Rehder, op. cit. **13**: 327 (1932).

When reducing *D. Esquirolii* Lévl. to a synonym of *D. cinerascens* Franch. in 1932, I overlooked the fact that Franchet's name was invalidated by the earlier *D. cinerascens* A. Gray of 1853 and also that I had already in 1921 proposed the name *D. Franchetii* for that invalidated name. As *D. Esquirolii* Lévl. is seven years older than *D. Franchetii,* the former becomes the valid name of this species.

Lespedeza fasciculiflora Franchet, Pl. Delavay. 169 (1889). — Handel-Mazzetti, Symb. Sin. **7**: 572 (1933).

Lespedeza Monnoyeri Léveillé. — Rehder in Jour. Arnold Arb. **13:** 328 (1932).

Lespedeza Monnoyeri was identified by Handel-Mazzetti with *L. fasciculiflora* Franch. which was reduced by Schindler (in Fedde, Rep. Spec. Nov. **23:** 354. 1927) to a variety of *L. floribunda* Bge., but seems sufficiently distinct from that species.

Dalbergia Cavaleriei Léveillé. — Rehder in Jour. Arnold Arb. **13:** 330 (1932). — Handel-Mazzetti, Symb. Sin. **7:** 574 (1933). — Merrill in Lingnan Sci. Jour. **13:** 30 (1934).

This species was collected in Kweichou also by Handel-Mazzetti (no. 10352), and in Kwangtung by W. T. Tsang (no. 20467: see Merrill, l. c.).

Dumasia villosa DeCandolle. — Rehder in Jour. Arnold Arb. **13:** 330 (1932). — Handel-Mazzetti, Symb. Sin. **7:** 578 (1933).

Handel-Mazzetti cites *Apios Martini* Lévl. of which he has seen the type, as a synonym of *D. villosa;* he doubts the specific difference of *D. hirsuta* Craib which differs chiefly in its short racemes.

Glycine Soja Siebold & Zuccarini in Abh. Akad. Wiss. Muench. **4** (pt. 2)**:** 119 (Fl. Jap. Fam. Nat. **1:** 11) (1845).

Glycine ussuriensis Regel & Maack, Tent. Fl. Ussur. 50, t. 7, figs. 5–8 (1861).

Rhynchosia Argyi Léveillé in Mem. Acad. Ci. Art. Barcelona, ser. 3, **12:** 555 (Cat. Pl. Kiang-Sou, 15) (1916). — **Synon. nov.**

China. Kiangsu: without locality, *Ch. d'Argy,* nos. 200, 201 [1844–66]: Tchang-hay, route de Zi-ka-wei, dans les haies, *E. Bodinier,* Sept. 1891 (syntypes of *Rhynchosia Argyi;* photo. in A. A.).

Glycine ussuriensis is apparently not specifically different from *G. Soja* Sieb. & Zucc. which is probably the wild form of the soja or soy-bean, *G. hispida* (Moench) Maxim., much cultivated in eastern Asia.

Mucuna Birdwoodiana Tutcher in Jour. Linn. Soc. Bot. **37:** 65 (1905). — Merrill in Lingnan Sci. Jour. **13:** 30 (1934).

Mucuna Bodinieri Léveillé. — Rehder in Jour. Arnold Arb. **13:** 330 (1932).

Mucuna Bodinieri was identified by Merrill (l. c.) with *M. Birdwoodiana,* a species originally described from Hongkong.

Pueraria Thunbergiana (Sieb. & Zucc.) Bentham. — Rehder in Jour. Arnold Arb. **13:** 331 (1932). — Merrill in Lingnan Sci. Jour. **14:** 14 (1935).

All the Léveillé names are cited as synonyms by Merrill (l. c.).

Backer, Nutt. Pl. Ned. Ind. Ed. 2, **2:** 829 (1927) published *Pueraria*

triloba as a new combination for this species, based on *Pachyrhizus trilobus* (Lour.) DC., but this combination had already been published for the same species by Makino (in Iinuma, Somoku Dzusetsu, ed. 3, **3**: 954, t. 22 [pt. 13] 1912) based on *Dolichos trilobus* Houttuyn (1779) which only partly (as to the plant figured) represents *Pueraria Thunbergiana;* otherwise it stands for the Linnean species (*Dolichos trilobus* L. = *Phaseolus trilobus* [L.] Ait.). Also *Dolichos trilobus* Lour. is a misapplication of the Linnean name since the description refers to *P. Thomsoni* Benth. (cf. Gagnepain in Lecomte, Fl. Gen. Indo-Chine, **2**: 251. 1916, and Merrill, Comm. Lour. Fl. Cochinch. 211. 1935).

OXALIDACEAE

Biophytum Esquirolii Léveillé in Fedde, Rep. Spec. Nov. **12**: 181 (1913). — Knuth in Engler, Pflanzenreich, iv. **130** (Heft 95): 413 (1930). — Merrill in Lingnan Sci. Jour. **13**: 31 (1934). — Merrill & Chun in Sunyatsenia, **2**: 250 (1935).

Biophytum Reinwardtii "Edgew. & Hook. f." ex Forbes & Hemsley in Jour. Linn. Soc. Bot. **23**: 99 (1886); non Klotzsch.

China. Kweichou: *J. Esquirol,* no. 811, in 1906 (holotype of *B. Esquirolii;* photo. in A. A.).

The Chinese specimens referred to *B. Reinwardtii* (Zucc.) Klotzsch do not belong to that species; they were referred by Knuth (l. c.) partly to *B. Thorelianum* Guill. var. *sinense* Guill. and partly to *B. Esquirolii* Lévl., but Merrill (l. c.) considers Guillaumin's variety identical with *B. Esquirolii.*

RUTACEAE[1]

Zanthoxylum rhetsoides Drake in Jour. de Bot. **6**: 275 (1892). — Guillaumin in Lecomte, Fl. Gén. Indo-Chine, **1**: 640 (1911).

Zanthoxylum odoratum (Lévl.) Léveillé. — Rehder in Jour. Arnold Arb. **14**: 224 (1933). — Merrill in Lingnan Sci. Jour. **13**: 33 (1934). — Chun in Sunyatsenia, **2**: 75 (1934). — **Synon. nov.**

Zanthoxylum myriacanthum Dunn & Tutcher in Kew Bull. Misc. Inform. Add. Ser. **10**: 50 (Fl. Kwangtung) (1912). — Merrill in Lingnan Sci. Jour. **6**: 279 (1928). — Non Wallich.

Fagara odorata (Lévl.) Handel-Mazzetti, Symb. Sin. 7: 623 (1933).

Zanthoxylum odoratum has been identified by E. D. Merrill with *Z. rhetsoides;* a note of this identification will be published by Merrill & Chun in a later issue of Sunyatsenia. The range of the species extends now from Tonkin to Kwangtung, Hunan and Kweichou.

[1]See Vol. **14**: 223.

Zanthoxylum Chaffanjoni Léveillé. — Rehder in Jour. Arnold Arb. **14:** 223 (1933).

Fagara Chaffanjoni (Lévl.) Handel-Mazzetti, Symb. Sin. **7:** 625 (1933).

Handel-Mazzetti gives a full Latin description of this species based on the type, on Cavalerie's 640 (p.p.) and his own no. 10433, all from Kweichou.

Boenninghausenia albiflora (Hook.) Meissner, Pl. Vasc. Gen. **2:** 44 (1836). — Rehder in Jour. Arnold Arb. **14:** 225 (1933).

In 1933 I credited the publication of the binomial to Heynhold (1840), but later I found that it had been published four years earlier by Meissner.

Boenninghausenia albiflora var. **brevipes** Franchet. — Rehder in Jour. Arnold Arb. **14:** 225 (1933).

Boenninghausenia sessilicarpa Léveillé. — Handel-Mazzetti, Symb. Sin. **7:** 628 (1933).

Handel-Mazzetti considers *B. sessilicarpa* specifically distinct and states that it differs not only in its fruit, but also in its open, star-shaped, not campanulate corolla.

Clausena Dunniana Léveillé. — Rehder in Jour. Arnold Arb. **14:** 226 (1933). — Handel-Mazzetti, Symb. Sin. **7:** 630 (1933).

Handel-Mazzetti refers to this species besides *C. Willdenowii* "W. & A." ex Léveillé (non Wight & Arnott), also *C. excavata* "Burm." ex Léveillé non Burm.

MELIACEAE[1]

Chukrasia tabularis A. Jussieu. — Rehder in Jour. Arnold Arb. **14:** 227 (1933), "Chickrassia."

In his China Rev. Ann. 1916, p. 23, a manuscript publication, Léveillé cites *Disoxylon* [sic] *Esquirolii* as a synonym of *Cipadessa fruticosa* Bl. = *C. baccifera* (Roth) Miq., but the rather large cylindric flower buds of the type of *Dysoxylon Esquirolii* show at once that the specimen belongs to *Chukrasia* and not to *Cipadessa* which has small subglobose buds.

Aglaia tetrapetala (Pierre) Pellegrin in Lecomte, Fl. Gén. Indo-Chine, **1:** 773 (1911).

Lepiaglaia ? tetrapetala Pierre, Fl. For. Cochinch. **5:** t. 337, in textu (1899), *Aglaia ? tetrapetala* pro synon. et sub tabula.

[1]See Vol. **14:** 227.

Ficus Ouangliense [!] Léveillé in Fedde, Rep. Spec. Nov. **4**: 66 (1907). — **Synon. nov.**

Ficus Vanioti Léveillé in op. cit. **7**: 258 (1909); Fl. Kouy-Tchéou, 434 (1915), quoad specim. Cavalerie 2984. — **Synon. nov.**

China. Kweichou: ouest de Lo-fou, Ouang-li, *J. Cavalerie*, no. 2568, Nov. 1905 (holotype of *F. Ouangliense;* photo. in A. A.); Lo-fou, *Cavalerie*, no. 2984, April 1908 (holotype of *F. Vanioti;* fragments in A. A.).

In his Flore de Kouy-Tchéou Léveillé cites *Ficus ouangliensis* [!] as a synonym of *F. Vanioti*, and enumerates besides the two types, two specimens from Che-chen-ha-e [?], Esquirol nos. 3077 and 3078, which represent a species of *Ficus*, but are too fragmentary for identification.

Aglaia tetrapetala has been reported also from Kwangtung and Hainan (cf. Merrill in Lingnan Sci. Jour. **7**: 311, 1931) and is represented by many specimens in this herbarium.

POLYGALACEAE

Polygala arillata Hamilton ex D. Don Prodr. Fl. Nepal. 199 (1824).

China. Kweichou: forêts de Tong-tchéou, 1400 m., *J. Esquirol*, no. 3265, June 22, 1912 "fl. jaune, petite plante 0.5–2 m.; Kiang-long, Tchen-lin-tchéou, *J. Cavalerie*, no. 3796, June 1910 "fl. jaune." Yunnan: Mont Io-chan 3400 m., sous-bois; broussailles, Long-ky, brousse, 700 m., *E. Maire*, June and August 1912. (Photo. of Esquirol 3265 in A. A.).

The specimens cited above bear in Léveillé's herbarium an unpublished binomial under *Piptanthus* and later were described and figured in Léveillé's manuscript publication China Rev. Ann. 1916, p. 4, pl., as a new species of *Crotalaria*, but none of these names was ever validly published.

Polygala Dunniana Léveillé in Fedde, Rep. Spec. Nov. **9**: 326 (1911); Fl. Kouy-Tchéou, 316 (1915). — Merrill in Lingnan Sci. Jour. **13**: 34 (1934). — Merrill & Chun in Sunyatsenia, **2**: 254 (1935).

China. Kweichou: Pic du Ko-tchang-keou, face Nord, *J. Esquirol*, no. 206, Sept. 1904 (holotype).

Polygala Dunniana was identified by Merrill with Chun & Tso, no. 44199, from Kwangtung.

Polygala japonica Houttuyn, Natuurl. Hist. Pt. II. **10**: 89, pl. 62, fig. 1 (1779).

Polygala Taquetii Léveillé in Fedde, Rep. Spec. Nov. **12**: 181 (1913). — **Synon. nov.**

KOREA. Quelpaert: in herbidis Polmongi, *E. Taquet*, no. 671, Apr. 1908 (holotype of *P. Taquetii;* photo. in A. A.).

EUPHORBIACEAE[1]

Andrachne Esquirolii Léveillé. — Rehder in Jour. Arnold Arb. **14**: 229 (1933). — Handel-Mazzetti, Symb. Sin. **7**: 1372 (1936).

Andrachne attenuata Handel-Mazzetti . . . add: Symb. Sin. **7**: 219 (1931).

Handel-Mazzetti (l. c. 219) gives a revised Latin description of his *A. attenuata*.

Phyllanthus Bodinieri (Lévl.), comb. nov.

Sterculia Bodinieri Léveillé, Fl. Kouy-Tchéou, 406 (1915).

Phyllanthus spec. Rehder in Jour. Arnold Arb. **14**: 231 (1933).

Frutex glaberrimus ramis strictis pallide flavo-griseis sparse lenticellatis, ramulis anguste alatis. Folia disticha, subcoriacea, brevissime petiolata, ovato-lanceolata, 2–3.5 cm. longa et 8–12 mm. lata, acuminata apice acutiuscula, basi late cuneata, margine revoluta, supra luteo-viridia, subtus pallidiora, costa media utrinque elevata, nervis utrinsecus 4–5 fere obsoletis; petioli vix 1 mm. longi. Flores monoeci, graciliter pedicellati, purpurei, in fasciculis ad 7-floris axillaribus secus ramulos laterales 3–8 cm. longos; masculi 4 mm. diam., sepalis 4 late ovatis integris, glandulis 4 distinctis horizontaliter ovalibus medio concavis, staminibus 2, in columnam brevissimam connatis apice antherarum loculos 4 horizontaliter dehiscentes et fere annulatim dispositos gerentibus, pedicellis 3–7 mm. longis; feminei 4–4.5 mm. diam., sepalis 6 rotundatis, disco cupuliformi ovarium globosum glabrum triente superiore excepto arcte cingente et tegente, stylis 3 liberis, ad medium in stigmata 2 partitis, pedicellis 6–10 mm. longis. Fructus desideratur.

CHINA. Kweichou: environs de Hoang-ko-chou, grande cascade, au bord de l'eau, *J. Seguin* in herb. *Bodinier*, no. 2194, April 1898, "arbuste, fleurs rougeâtres" (holotype of *Sterculia Bodinieri;* merotype and photo. in A. A.).

This plant apparently represents a new species of the section ERIOCOCCUS (§ Reidia [Wight] Hook. f.) and as the original description is insufficient a complete description has been given above. The species is chiefly characterized by the entire sepals, 6 in the pistillate flower, the very short staminal column, the 4 distinct glands of the disk in the staminate flower and the cupular disk of the pistillate flower, the glabrous ovary, the styles divided to the middle, and the ovate lanceolate leaves 2–3.5 cm. long and not oblique at base.

[1]See Vol. **14**: 229.

Bischofia javanica Blume, Bijdr. 1168 (1825). — Schneider in Sargent, Pl. Wilson. **3:** 275 (1916), 455 (1917).

Celtis polycarpa Léveillé in Fedde, Rep. Spec. Nov. **11:** 296 (1912); Fl. Kouy-Tchéou, 424 (1915); China Rev. Ann. 1916, p. 29 (MS), pro synon. *Bischofiae sinensis* Bl.

China. Kweichou: Gan-chouen (Choin-tang-tchiai), *J. Cavalerie,* no. 3790, May–Oct. 1910 (holotype of *Celtis polycarpa;* photo. in A. A.).

Celtis polycarpa was first identified with *Bischofia javanica* by Schneider (l. c.). Léveillé in his manuscript publication "China, Rev. Ann. p. 29 (1916)" refers it to *Bischofia,* probably having been notified of the correct identification by Schneider, to whom he had sent fragments for Schneider's study of the Chinese *Celtis.*

Bridelia spec.

Lindera spec. Léveillé, Fl. Kouy-Tchéou, 219 (1914).

China. Kweichou: route de Tong-tchéou, *J. Esquirol,* no. 3747, July 1912 (fragments in A. A.).

The specimen apparently belongs in the affinity with *B. minutiflora* Hook. f., but differs in the leaves being of thinner texture, green and quite glabrous beneath and somewhat lustrous above; it agrees in these characters with Y. Tsiang 7252 from Kweichou.

Mallotus Esquirolii Léveillé in Fedde, Rep. Spec. Nov. **9:** 327 (1911); Fl. Kouy-Tchéou, 165 (1914), specim. Esquirol 3225, (? 902), et Cavalerie 3114 exclud. — Pax & Hoffmann in Engler, Pflanzenr. IV. **147**[vii]**:** 196 (1914), quoad Esquirol, no. 898. — Rehder in Jour. Arnold Arb. **14:** 232 (1933), exclud. Cavalerie no. 3114.

China. Kweichou: without locality, *J. Esquirol,* no. 898 (holotype; photo. in A. A.); Pe-tung, *J. Esquirol,* no. 898 ?, "arbrisseau 2 mètres" (not a type; photo. in A. A.); Ouang-mou, ruisseau de Dong-á, *J. Esquirol,* no. 65, June 1904 (cited in Fl. du Kouy-Tchéou).

There are two sheets of Esquirol no. 898 in the Léveillé herbarium, one a staminate specimen which is the type with the name *Mallotus Esquirolii* Lévl. in Léveillé's hand on a printed label, but without locality, and an identification label by Pax; the other sheet bears what is apparently Esquirol's original label with the locality "Pe-tung" and a note "ne serait ce pas le fruit du no. 898?" referring evidently to detached fruits in a pocket; the specimen itself has two fruiting racemes with all the fruits fallen off. The opposite leaves are very unequal, the smaller ones only ½ or ⅓ the size of the larger ones, often ovate and subcordate or rounded at base and borne on very short petioles or nearly subsessile.

Henry's no. 13023 cited by Pax under *M. Esquirolii* differs in its slenderer pedicels of the fruit, about 1 cm. long, stouter, recurved, and only 2–4 mm. long in *M. Esquirolii* — and in the much less unequal opposite leaves, the smaller ones more than half as long as the larger ones and on petioles 5–12 mm. long. Esquirol no. 65 is very fragmentary and has neither flowers nor fruits.

Esquirol no. 3225 from Ka-riang described as a sarmentose shrub and Cavalerie no. 3114 from Lo-fou cited by Léveillé in his Flore du Kouy-Tchéou under *M. Esquirolii* belong to *Cleidion brevipetiolatum* Pax & Hoffm. Esquirol no. 902 I have not seen; it could not be located in the Léveillé herbarium.

Macaranga Esquirolii (Lévl.), comb. nov.

Morinda Esquirolii Léveillé, Fl. Kouy-Tchéou, 368 (1915). — **Synon. nov.**

CHINA. Kweichou: bois de Ta-ram, *J. Esquirol,* no. 3735, Aug. 1912 (holotype; photo. in A. A.).

This species is closely related to *M. bracteata* Merr., but differs in the elliptic-oblong to ovate-lanceolate leaves with the greatest diameter in the middle, gradually narrowed into a long caudate acumen, 3-nerved at base, entire or minutely and sparingly mucronate denticulate, the glands of the underside pale, not dark, and the midrib and petiole puberulous, not pilose.

Tragia Mairei (Lévl.), comb. nov.

Alchornea Mairei Léveillé, Cat. Pl. Yun-Nan, 94 (1916).

Traga involucrata sensu Handel-Mazzetti, Symb. Sin. **7**: 218 (1931), quoad synon. — Rehder in Jour. Arnold Arb. **14**: 234 (1933), quoad synon. — Non Linnaeus.

CHINA. Yunnan: vallon de You-fong-keou, alt. 800 m., *E. E. Maire,* July 1913, "Urtica vivace grimpante, fl. vertes" (holotype of *Alchornea Mairei;* photo. in A. A.).

When I identified *Alchornea Mairei* with *Traga involucrata,* following Handel-Mazzetti, I had only a photograph of the type specimen. I now have before me the original specimen kindly sent me on loan from Edinburgh, and find that on account of its entire sepals, it is quite different from *T. involucrata* L. It is very near *T. anisosepala* Merrill & Chun (in Sunyatsenia, **2**: 261, pl. 62. 1935), from which it differs chiefly in the smaller ovate leaves occasionally with two small lateral lobes below the middle, and it may not be specifically distinct. Merrill and Chun place their species with the Sect. TAGIRA subsect. HOLOCALYX Pax & Hoffm., but on account of the sessile anthers, it seems to fit better into the Sect. AGIRTA Baill. In the unequal sepals of the pistillate flower,

however, *T. Mairei* and *T. anisosepala* differ from both sections which moreover, are restricted to Africa and Madagascar.

BUXACEAE[1]

Buxus megistophylla Léveillé. — Gagnepain in Lecomte, Fl. Gén. Indo-Chine, **5:** 661 (1927). — Rehder in Jour. Arnold Arb. **14:** 236 (1933).

In 1933, when taking up *B. megistophylla* as a distinct species, I overlooked the fact that Gagnepain (l. c.) had already recognized this species by including it in his key of the species of *Buxus*.

Buxus Myrica Léveillé. — Gagnepain in Lecomte, Fl. Gén. Indo-Chine, **5:** 662 (1927). — Rehder in Jour. Arnold Arb. **14:** 236 (1933).

When publishing a full Latin description of this species in 1933, I was not aware that Gagnepain (l. c.) had already given a detailed description, and also described a new variety, var. *angustifolia*, from Indochina and Kweichou; to that variety apparently belongs Bodinier no. 2266.

AQUIFOLIACEAE[2]

Ilex purpurea Hasskarl. — Rehder in Jour. Arnold Arb. **14:** 239 (1933).

Symplocos Courtoisii Léveillé in Mem. Acad. Ci. Art. Barcelona, ser. 3, **12:** 562 (Cat. Pl. Kiang-Sou, 22) (1916). — **Synon. nov.**

China. Kiangsu: without locality, *Ch. d'Argy* [1844–66] (holotype of *Symplocos Courtoisii;* photo. in A. A.).

The specimen cited above is in fruit; the specimens representing the synonyms cited in 1933 are in flower and are all from Kweichou.

Ilex macrocarpa Oliver. — Rehder in Jour. Arnold Arb. **14:** 242 (1933). — Handel-Mazzetti, Symb. Sin. **7:** 659 (1933).

Handel-Mazzetti cites *Diospyros Bodinieri* Lévl. as a synonym.

CELASTRACEAE[3]

Evonymus centidens Léveillé. — Rehder in Jour. Arnold Arb. **14:** 244 (1933). — Handel-Mazzetti, Symb. Sin. **7:** 661 (1933).

Handel-Mazzetti cites a specimen from western Szechuan (Faber, Mt. Omei, in 1887, as *E. Thunbergiana* var. *oblongifolia*).

[1]See Vol. **14:** 235.
[2]See Vol. **14:** 239.
[3]See Vol. **14:** 242; **15:** 1.

Microtropis fokienensis Dunn in Jour. Linn. Soc. Bot. **38**: 357 (1908).

Myrsine Chaffanjoni Léveillé, Fl. Kouy-Tchéou, 287 (1914). — **Synon. nov.**

CHINA. K w e i c h o u : environs de Kouy-yang, mont du Collège, *J. Chaffanjon* in herb. *Bodinier*, no. 2048, Jan.–Feb. 1898 "grand arbuste, presque un arbre, fleurs verdâtres-jaunâtres" (holotype of *Myrsine Chaffanjoni;* photo. in A. A.).

In Chaffanjon's specimen, some inflorescences are borne at the apex of short axillary branchlets and have the appearance of pedunculate inflorescences which would make the specimen referable to var. *longipedunculata* Cheng, but in reality, these inflorescences are subsessile like the others on the same branch. It may be mentioned here that the var. *longipedunculata* has also been collected in Hainan (C. Wang, 35276, 35652 and 36559) and in Kwangsi (W. T. Tsang, 22639). The type is also known from Yunnan (Rock, 7536), from Kwangsi (W. T. Tsang 22791) and from Hainan (Chun & Tso 44040), the latter somewhat intermediate.

Trypterygium hypoglaucum (Lévl.) Hutchinson. — Rehder in Jour. Arnold Arb. **14**: 252 (1933); **15**: 1 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 665 (1933).

Handel-Mazzetti cites *Aspidopterys hypoglauca* Lévl. as a synonym.

ACERACEAE[1]

Acer Buergerianum Miq. var. **formosanum** (Hay. ex Koidz.), comb. nov.

Acer trifidum Hook. & Arn. var. *formosanum* Hayata ex Léveillé in Bull. Soc. Bot. France, **53**: 593 (1906), nom. nud. — Koidzumi in Jour. Coll. Sci. Tokyo, **32** art. 1: 30 (1911). — Hayata, Ic. Pl. Formos. **1**: 156 (1911).

FORMOSA: Kelung, in rupibus secus mare, *U. Faurie*, no. 65, June 15, 1903 (holotype of *A. trifidum* var. *formosanum;* photo. in A. A.).

This variety differs from the type in the very short obtuse or obtusish lobes of the leaves, mostly broader than high, the middle lobe 1–1.5 cm. long and about 2 cm. broad, the upper side of the lateral lobes diverging horizontally from the middle lobe and forming a right angle with the outer margin, and in the diverging wings of the fruit. Neither Hayata nor Léveillé give a description; Koidzumi's publication apparently precedes Hayata's since the latter cites Koidzumi though incorrectly, but

[1]See Vol. 15: 4.

Koidzumi's publication is dated Nov. 20, 1911, while Hayata's is dated Sept. 15, 1911.

SAPINDACEAE[1]

Handeliodendron Bodinieri (Lévl.) Rehder in Jour. Arnold Arb. **16:** 66, fig. 1, pl. 119 (1935).

Sideroxylon Bodinieri Léveillé, Fl. Kouy-Tchéou, 384 (1915).

China. Kweichou: district de Ly-po, *J. Cavalerie* in herb. *Bodinier,* no. 2626, Sept. 1898 (fruit), May 11, 1899, "grand arbre" (holotype of *Sideroxylon Bodinieri;* photo. in A. A.).

This species has been collected in Kweichou also by Y. Tsiang (no. 6813).

Eurycorymbus Cavaleriei (Lévl.) Rehder & Handel-Mazzetti in Jour. Arnold Arb. **15:** 8 (1934); in Bot. Centrbl. Beih. **52B:** 166 (Pl. Mell. Sin.) (1934). — Radlkofer in Engler, Pflanzenr. IV. **165:** 1505 (Sapind.) (1934).

Eurycorymbus austrosinensis Handel-Mazzetti. — Hu in Bull. Fan Mem. Inst. Biol. **1:** 38 (1929). — Merrill in Lingnan Sci. Jour. **7:** 313 (1931). — Handel-Mazzetti, Symb. Sin. **7:** 638 (1933). — Radlkofer in Engler, Pflanzenr. IV. **165:** 1432 (Sapind.) (1933).

In 1934 (in Jour. Arnold Arb. **15:** 9) I gave a description of the staminate flowers based on Kanehira no. 14225. The year before Yamamoto had published (in Jour. Soc. Trop. Agr. Taiwan, **5:** 182) a complete description including staminate and pistillate flowers, but the description was apparently based on sapindaceous material other than *Eurycorymbus.* I have seen none of the material cited by Yamamoto and do not know to which plant his descripton really applies.

SABIACEAE[2]

Meliosma Oldhamii Miquel in Ann. Mus. Bot. Lugd.-Bat. **3:** 94 (Prol. Fl. Jap. 258) (1867). — Rehder & Wilson in Sargent, Pl. Wilson. **2:** 206 (1914). — Rehder in Jour. Arnold Arb. **15:** 10 (1934).

Fraxinus Fauriei Léveillé in Fedde, Rep. Spec. Nov. **8:** 285 (1910). — **Synon. nov.**

Korea. Quelpaert: circa pagos, *U. Faurie,* no. 1867, Aug. 1907 (holotype of *Fraxinus Fauriei;* isotype in A. A.).

Faurie's no. 1867, labeled "Fraxinus" was identified by E. H. Wilson and the writer in 1914 (l. c.) with *Meliosma Oldhami,* without being aware that Léveillé had described this number four years earlier as *Fraxinus Fauriei.*

[1]See Vol. 15: 8.
[2]See Vol. 15: 9.

Meliosma cuneifolia Franchet in Nouv. Arch. Mus. Paris, sèr. 2, 8: 211 (Pl. David. 2: 29) (1886). — P'ei in Mem. Sci. Soc. China, 1, no. 3: 90 (Verben. China) (1932).

Premna Mairei Léveillé, Sert. Yunnan. 3 (1916); Cat. Pl. Yun-Nan, 298 (1917).

CHINA. Yunnan: fôret de Long-ky, 700 m., *E. E. Maire,* June 1912 (holotype of *Premna Mairei;* photo. in A. A.).

The identification by the writer of *Premna Mairei* with *Meliosma cuneifolia* was recorded in 1932 by P'ei (l. c.).

RHAMNACEAE[1]

Zizyphus pubinervis, nom. nov.

Strychnos Esquirolii Léveillé, Fl. Kouy-Tchéou, 262 (1914). — **Synon. nov.**

CHINA. Kweichou: chemin de Pett-tiang, *J. Esquirol,* no. 3737, June 1912 (holotype of *Strychnos Esquirolii;* photo. in A. A.).

As Léveillé's description is inadequate and misleading, the species may be here briefly redescribed, as far as the incomplete material permits:

Arbor vel frutex ramis gracilibus inermibus; folia chartacea, oblongo-lanceolata, 5–9 cm. longa et 2–3 cm. lata, satis longe et sensim acuminata, basi valde obliqua, uno latere cuneata, altero subrotundata, usque ad apicem minute serrulata, supra glabra, subtus pallidiora et ad costam et nervos laterales praecipue basim versus pilosa vel puberula, ceterum glabra, trinervia nervis supra impressis subtus prominentibus, nervis trabecularibus supra obsoletis subtus leviter elevatis et satis distantibus; petioli 2–4 mm. longi, pilosuli. Flores desunt. Fructus nondum perfecte maturi secus ramulos ultimos racemose dispositi, axillares, plerumque solitarii vel rarius 2–4 in cyma umbelliformi brevissime pedunculata, pedicellis 3–4 mm. longis pilosulis; drupa subgloboso-ovoidea, leviter compressa, 10–11 mm. longa et 9–10 mm. lata, apice mucronata, exocarpio ruguloso, monosperma.

This species is similar to *Z. inermis* Merr. of the Philippine Islands, which differs chiefly in the larger glabrous and entire subcoriaceous leaves cuneate and less oblique at the base and in the somewhat larger not compressed fruit. Léveillé described his species as having a large inflorescence composed of long racemes; he evidently mistook the slender lateral branchlets bearing axillary fruits for parts of a paniculate inflorescence. Since there is already a *Zizyphus Esquirolii* Lévl. which is *Hovenia dulcis* Thunb. (see Jour. Arnold Arb. 15: 17. 1934) Léveillé's

[1]See Vol. 15: 10.

specific epithet cannot be transferred to *Zizyphus* and the species may be called *Z. pubinervis* on account of the pilose or puberulous veins of the underside of the leaves.

Rhamnella Martini (Lévl.) Schneider. — Rehder in Jour. Arnold Arb. **15:** 11 (1934). — Handel-Mazzetti, Symb. Sin. **7:** 673 (1933). — Chun in Sunyatsenia, **2:** 74 (1934).

Rhamnus Martini Léveillé.

According to Chun (l. c.) the species has been collected also in Kwangtung (S. P. Ko 52815).

Rhamnella rubrinervis (Lévl.) Rehder in Jour. Arnold Arb. **15:** 12 (1934). — Merrill & Chun in Sunyatsenia, **2:** 39 (1934).

Embelia rubrinervis Léveillé.

Rhamnus Esquirolii Léveillé. — Rehder in Jour. Arnold Arb. **15:** 14 (1934). — Handel-Mazzetti, Symb. Sin. **7:** 675 (1933).

This species was collected in Kweichou also by Handel-Mazzetti (nos. 10600, 10650, 10747), by Steward & Cheo (nos. 61, 116, 510) and by Y. Tsiang (no. 5289).

Rhamnus Bodinieri Léveillé. — Rehder in Jour. Arnold Arb. **15:** 15 (1934). — Handel-Mazzetti, Symb. Sin. **7:** 676 (1933).

This species was collected in Kweichou also by Handel-Mazzetti (no. 10365).

Rhamnus Leveilleanus Fedde. — Rehder in Jour. Arnold Arb. **15:** 17 (1934). — Handel-Mazzetti, Symb. Sin. **7:** 676 (1933).

Rhamnus Cavaleriei Léveillé (1911, non 1910).

This species was collected in Kweichou also by Handel-Mazzetti (nos. 10110, 10260).

VITACEAE[1]

Tetrastigma obtectum (Wall.) Planch. var. *β* **glabrum** Gagnepain. — Rehder in Jour. Arnold Arb. **15:** 21 (1934).

Vitis Potentilla var. *glabra* Léveillé.

China. Kweichou: change line 7 of p. 21 to: *Cavalerie*, no. 1331 (May 1902), no. 1332 (June 4 and Oct. 1902), no. 3253 (Nov. 1907, May 1908).

Ampelopsis Delavayana var. **Gentiliana** (Lévl. & Vant.) Handel-Mazzetti, Symb. Sin. **7:** 682 (1933). — Rehder in Jour. Arnold Arb. **15:** 24 (1934). — Chun in Sunyatsenia, **2:** 75 (1934).

Vitis Gentiliana Léveillé & Vaniot.

[1]See Vol. 15: 18.

When I published this name as a new combinaton, I was not aware of Handel-Mazzetti's earlier publication of the same combination.

Ampelopsis Chaffanjoni (Lévl.) Rehder in Jour. Arnold Arb. **15:** 25 (1934). — Handel-Mazzetti in Bot. Centralbl. Beih. **52B:** 170 (1934).

Vitis Chaffanjoni Léveillé.

Ampelopsis aconitifolia Bunge in Mém. Sav. Ètr. Acad. Sci. St. Pétersb. **2:** 86 (Enum. Pl. Chin. Bor. 12) (1833).

Vitis heterophylla Thunb. var. *aconitifolia* Léveillé & Vaniot in Bull. Soc. Agr. Sci. Art. Sarthe, **40:** 39 (1905), nom. nud.

China. Hopei: Pekin, au cimetière à Cha-la-Eul, et à Tchen-fou-sé, *E. Bodinier,* no. 203, June 1889 (specimen in herb. Léveillé).

Cayratia oligocarpa (Lévl. & Vant.) Gagnepain. — Rehder in Jour. Arnold Arb. **15:** 26 (1934). — Handel-Mazzetti, Symb. Sin. **7:** 683 (1933).

Vitis oligocarpa Léveillé & Vaniot.

TILIACEAE[1]

Burretiodendron Esquirolii (Lévl.) Rehder in Jour. Arnold Arb. **17:** 48, pl. 178 (1936).

Pentace Esquirolii Léveillé in Fedde, Rep. Spec. Nov. **10:** 147 (1911); Fl. Kouy-Tchéou, 419 (1915). — Burret in Notizbl. Bot. Gard. Mus. Berlin-Dahlem, **9:** 620 (1926).

Eriolaena Esquirolii Léveillé, Fl. Kouy-Tchéou, 405 (1915).

China. Kweichou: ouest de Lo-fou (Kouai-kou), *J. Cavalerie,* no. 2648, Nov. 1905, "arbre moyen, moucilagineux" (holotype of *Pentace Esquirolii;* photo. in A. A.); same locality, *J. Esquirol,* no. 817 (cited in Fl. Kouy-Tchéou under *P. Esquirolii*): Yang-ly, *J. Esquirol,* no. 2717, Aug. 1911, "arbre 8–10 m., fleur blanche" (holotype of *E. Esquirolii,* also cited in Fl. Kouy-Tchéou under *P. Esquirolii;* photo. in A. A.).

Léveillé cites in Flore du Kouy-Tchéou Esquirol no. 2717 as the type of *Eriolaena Esquirolii* (p. 405) and again under *Pentace Esquirolii* (p. 419); the specimen itself bears no name whatever in Léveillé's handwriting. The species has been collected in Kweichou also by Y. Tsiang (no. 7290) and in Yunnan by A. Henry (nos. 9572 and 9573).

Grewia Feddei (Lévl.) Burret in Notizbl. Bot. Gart. Mus. Berlin-Dahlem, **9:** 678 (1926).

Celastrus Feddei Léveillé in Fedde, Rep. Spec. Nov. **13:** 263 (1914), excl. Esquirol, no. 3189.

[1]See Vol. **15:** 92.

Grewia spec. Loesener in Ber. Deutsch. Bot. Ges. **32**: 543 (1914).
Grewia glabrescens Benth. ex Léveillé, Fl. Kouy-Tchéou, 419 (1915), quoad syn. *Celastrus euonymoidea.*
Celastrus euonymoidea Léveillé, l. c. (1915), pro synon. *G. glabrescentis.*
Grewia parviflora var. *glabrescens* (Benth.) Rehder & Wilson in Sargent, Pl. Wilson. **2**: 371 (1915), quoad synon. *Celastrus euonymoidea* Lévl.
Grewia biloba G. Don. — Rehder in Jour. Arnold Arb. **15**: 92 (1934), quoad synon. *Celastrus euonymoidea* Lévl.

China. Kweichou: Lo-fou, *J. Cavalerie,* no. 3513, Apr. 1909, "arb. 2 m." (syntype of *Celastrus Feddei;* photo. in A. A.).

Neither of the two syntypes bears the name of *Celastrus Feddei;* Cavalerie, no. 3513, is labeled *C. euonymoideus* and Esquirol no. 3189 bears no name except *Euonymus* crossed out; the former also has an identification label "Grewia ex Schlechter."

Burret (l. c.) places *Grewia Feddei* near *C. glabra* Bl. (*G. laevigata* Auct., nec Vahl) from which it is chiefly distinguished by the scattered stellate hairs on both sides of the leaves and the less long and slender acuminate apex. From *G. biloba* G. Don it may be distinguished by the oblong, more finely serrate and only slightly stellate-pubescent leaves and by the peduncles being at least twice as long as the petioles.

As Burret mentions in his discussion of *G. Feddei* only Cavalerie no. 3513 from Lo-fou of which he saw but fragmentary material, it is apparent that his species does not include the second syntype which is identical with *G. Henryi* Burret.

Grewia Henryi Burret in Notizbl. Bot. Gart. Mus. Berlin, **9**: 674 (1926).

Celastrus Feddei Léveillé in Fedde, Rep. Spec. Nov. **13**: 263 (1914) quoad specim. Esquirol, no. 3189. — **Synon. nov.**
Grewia glabrescens Benth. ex Léveillé, Fl. Kouy-Tchéou, 419 (1915), quoad synon. *G. Esquirolii.*
Grewia Esquirolii Léveillé, Fl. Kouy-Tchéou, 419 (1915), pro synon. praecedentis.
Grewia parviflora var. *glabrescens* Rehder & Wilson in Sargent, Pl. Wilson. **2**: 371 (1915), quoad syn. *Grewia Esquirolii.*
Grewia biloba G. Don. — Rehder in Jour. Arnold Arb. **15**: 92 (1934), quoad synon., *G. Esquirolii.*

China. Kweichou: Goui-reou, *J. Esquirol,* no. 3189, Dec. 1911 (syntype of *Celastrus Feddei;* photo. in A. A.); Lo-fou, *J. Esquirol,* no. 2204, Sept. 1910, and *J. Cavalerie,* no. 3492, Aug. 1909 (cited under *G. glabrescens* in Fl. Kouy-Tchéou; photos. in A. A.).

The second syntype of *Celastrus Feddei*, Esquirol no. 3189, bears no name on its label except *Euonymus* crossed out, but as the first syntype is labeled *C. euonymoideus*, the name *Grewia Esquirolii* must belong to the second syntype which differs from the first syntype in the rather densely stellate pubescent underside of the leaves and is apparently referable to *G. Henryi*. It is easily distinguished from *G. biloba* by the oblong leaves, the longer peduncles with usually only two or three long pedicels. It is more closely related to *G. Feddei* (Lévl.) Burret which chiefly differs in the leaves being only sparingly stellate-pubescent beneath, the hairs spaced and with shorter appressed rays about 0.25 mm. long (not more or less upright-spreading and about 0.5 mm. long), in the appressed setose petiole and midrib beneath, and in the less acuminate leaves.

STERCULIACEAE[1]

Paradombeya sinensis Dunn in Hooker's Ic. Pl. **28**: t.2743B (1902).

Lysimachia Mairei Léveillé in Bull. Géog. Bot. **25**: 44 (1915); Cat. Pl. Yun-Nan, 211 (1917). — **Synon. nov.**

Clematoclethra sp. Handel-Mazzetti in Not. Bot. Gard. Edinb. **16**: 122 (1928).

CHINA. Yunnan: rochers, rives du fleuve Bleu, à Kiang-pien, 350 m., *E. E. Maire*, Aug. 1912, "arbuste buissonant, fl. jaunes" (holotype of *Lysimachia Mairei;* photo. in A. A.).

I have not seen the type specimen of *P. sinensis*, but E. E. Maire's specimen agrees well with Dunn's description and plate. The same species has also been collected in Ping-shan-hsien, Szechuan, by T. T. Yü (no. 4152).

DILLENIACEAE[2]

Actinidia eriantha Bentham in Jour. Linn. Soc. **5**: 55 (1861). — Chun in Sunyatsenia, **1**: 273 (1934).

Actinidia lanata Hemsley in Ann. Bot. **9**: 146 (1895). — Rehder in Jour. Arnold Arb. **15**: 97 (1934).

Ficus hirtaeformis Léveillé & Vaniot.

Mespilus Esquirolii Léveillé.

Chun (l. c.) considers *A. lanata* Hemsl. a distinct species, but none of the distinguishing characters given by him and other authors seem to be dependable. Also *A. Davidii* Franch. belongs here according to Handel-Mazzetti (Symb. Sin. **7**: 391).

[1]See Vol. 15: 95.
[2]See Vol. 15: 96.

THEACEAE[1]

Camellia[2] **Costei** Léveillé.

Thea Costei (Lévl.) Rehder in Jour. Arnold Arb. **15**: 98 (1934).
Thea sinensis Seem. var. *androxantha* Léveillé.

Camellia Grijsii Hance in Jour. Bot. **17**: 9 (1879).

Thea Grijsii (Hance) Kochs. — Rehder, l. c. (1934).
Thea Cavaleriana Léveillé.

Camellia Pitardii Cohen Stuart in Mededeel. Proefstat. Thee Buitenzorg **40**: 68 (1916); in Bull. Jard. Bot. Buitenzorg, ser. 3, **1**: 240 (1919).

Camellia japonica "L." sensu Léveillé; non Linnaeus.
Thea Pitardii (Stuart) Rehder. — Rehder in Jour. Arnold Arb. **15**: 98 (1934), excl. synon. *Thea Mairei.*

Camellia Pitardii Cohen Stuart var. **lucidissima** (Lévl.), comb. nov.

Thea Camellia var. *lucidissima* Léveillé.
Thea Pitardii (Stuart) Rehd. var. *lucidissima* (Lévl.) Rehder, l. c. (1934).

Camellia Mairei (Lévl.) Melchior in Engler & Prantl, Pflanzenfam. ed. 2, **21**: 129 (1925).

Thea Mairei Léveillé, Sert. Yunnan, 2 (1916); Cat. Pl. Yun-Nan, 271 (1917).
Thea Pitardii Rehder in Jour. Arnold Arb. **15**: 98 (1934), pro parte, quoad syn. *Thea Mairei,* non (Cohen Stuart) Rehder (1924).

Melchior (l. c.) places *C. Mairei* into the Sect. ERIANDRIA together with *C. caudata* Wall., *C. assimilis* Champ. and *C. gracilis.* It is evident that Melchior could not have seen the type specimen and has relied solely on Léveillé's description of the stamens as being densely villous, for *C. Mairei* belongs to the Sect. EUCAMELLIA and is very similar to *C. Pitardii* (C. Stuart) Rehd. but differs strikingly in its pubescent filaments, a character found in no other species of the genus except in the species of the Sect. ERIANDRIA.

Camellia oleosa (Lour.), comb. nov.

Thea oleosa Loureiro, Fl. Cochinch. 339 (1790); ed. Willd. 414 (1793). — Rehder in Jour. Arnold Arb. **15**: 98 (1934). — Merrill in Trans. Am. Phil. Soc., n. ser., **24**: 266 (Comm. Lour. Fl. Cochinch.) (1935).
Camellia drupifera Loureiro, Fl. Cochinch. 411 (1790); ed. Willd. 499 (1793).
Thea podogyna Léveillé.

[1]See Vol. **15**: 98.

[2]Since according to Art. D. 20. of the International Rules of Nomenclature which was accepted at Amsterdam, the two volumes of Linnaeus, Species plantarum are considered of the same date, the name *Camellia* becomes the valid name according to article 56 and the correct combinations under *Camellia* are given here of the species cited in 1934 under *Thea.*

As Merrill is apparently the first author who united *Thea oleosa* Lour. and *Camellia drupifera* Lour. published simultaneously as distinct species by Loureiro, and as he in doing so adopted *Thea oleosa* and cited *Camellia drupifera* as a synonym, *Camellia oleosa* will be the correct name under *Camellia*.

Gordonia axillaris (Ker) Szyszylowicz in Engler & Prantl, Nat. Pflanzenfam. III. **6**: 185 (1893).

CHINA. Yunnan: brousse de Tchen-feng-chan, alt. 750, *E. E. Maire,* Aug. [1912–14?].

The specimen cited above was described by Léveillé in the manuscript publication China Rev. Ann. 1916, p. 6, as a new species of *Castanopsis*.

GUTTIFERAE[1]

Hypericum erectum Thunberg, Fl. Jap. 295 (1784). — Léveillé in Bull. Soc. Bot. France, **53**: 500 (1906).

Hypericum erectum var. *axillare* Léveillé, l. c. (1906).
Hypericum Vanioti Léveillé, l. c. (1906), excl. Faurie 5508.
Hypericum Matsumurae Léveillé, l. c. 501 (1906).

JAPAN. Hondo: *U. Faurie,* no. 4, July 1900, nos. 10 and 11 in 1904, no. 12 in 1905, nos. 14, 15 in 1905, no. 1350, Sept. 24, 1898, no. 5038, Aug. 1902 (syntypes of *H. Vanioti*). Hokkaido: Shakotan, *U. Faurie,* no. 1, Sept. 1904 (holotype of *H. Matsumurae*); without special locality, *U. Faurie,* no. 6, July 1905 (holotype of *H. erectum* var. *axillare;* ex Léveillé).

Hypericum erectum is a very variable species and G. Koidzumi who examined and attached identification labels to the specimens cited above, distinguished besides the typical form (Faurie nos. 4, 10, 11, 12) the following varieties: *H. erectum* var. *axillare* Lévl. (Faurie 6159), var. *obtusifolium* Bl. (Faurie, nos. 1, 1350), var. *thyrsoideum* Bl. (Faurie, nos. 14, 15); Faurie 3058 is named *H. vulcanicum* Koidz.?" which is a synonym of *H. erectum* f. *Fauriei* R. Keller.

Of the several syntypes of *H. Vanioti,* only Faurie no. 10 bears the name *H. Vanioti* in Léveillé's handwriting. On the holotype of *H. Matsumurae,* Faurie no. 1, no name appears.

Hypericum otaruense R. Keller in Bull. Herb. Boiss. **5**: 641 (1897). — Léveillé in Bull. Soc. Bot. France, **53**: 502 (1906).

Hypericum Dielsii Léveillé, l. c. 499 (1906).
Hypericum Vanioti Léveillé, l. c. 501 (1906), quoad specim. Faurie no. 5508.

[1]See Vol. 15: 100.

JAPAN. Hokkaido: Junsainuma, *U. Faurie,* no. 5508, Aug. 1903 (syntype of *H. Vanioti*); without precise locality, *U. Faurie,* no. 7, July 1905 (holotype of *H. Dielsii*).

Both specimens cited above have been determined by Koidzumi as *H. otaruense* which is near *H. erectum,* but seems to differ chiefly in the deeply cordate base of the leaves gradually narrowed toward the obtuse apex.

Hypericum napaulense Choisy in DeCandolle, Prodr. **1**: 552 (1924). — Handel-Mazzetti, Symb. Sin. **7**: 402 (1931).

Hypericum Bodinieri Léveillé in Bull. Soc. Agr. Sci. Sarthe, **39**: 322 (1904); Fl. Kouy-Tchéou, 198 (1914); Cat. Pl. Yun-Nan, 133 (1916).

CHINA. Kweichou: Lo-fou, Pin-fa, rare, *J. Cavalerie,* no. 2768, Apr. 1906, "fl. jaunes" (syntype of *H. Bodinieri*). Yunnan: frontière du Kouy-Tchéou, à Kian-ty, bord du fleuve, rive du Yunnan, *E. Bodinier,* no. 1517, Apr. 9, 1897, "fleurs jaunes" (syntype of *H. Bodinieri;* photo. in A. A.).

Hypericum Bodinieri was identified by Handel-Mazzetti with *H. napaulense* from an isotype of Bodinier's specimen. The plant sends up simple slender herbaceous stems from a subligneous creeping rootstock. The oval to oval-oblong obtuse leaves are about 1.5 cm. long and closely glandular-ciliate, at the clasping base they are densely setose-glandular with some of the setae up to 1.5 mm. long. The plant may represent a distinct variety of *H. napaulense;* in the Himalayan specimens I have seen, the leaves were only slightly and sometimes not at all glandular-ciliate.

PASSIFLORACEAE

Passiflora Seguini Léveillé & Vaniot in Bull. Acad. Intern. Géog. Bot. **17**: 174 (1902). — Handel-Mazzetti, Symb. Sin. **7**: 384 (1931).

Passiflora cupiformis Mast. ex Léveillé, Fl. Kouy-Tchéou, 312 (1915), quoad syn. *P. Seguini;* non Masters (1888).

CHINA. Kweichou: cascade de Hoang-ko-chou, sur les rochers, *J. Seguin,* no. 2350, June 11, 1898, "liane herbacée, fleurs blanches" (holotype; photo. in A. A.).

In 1915, Léveillé reduced this species to a synonym of *P. cupiformis;* Handel-Mazzetti (l. c.) keeps it as a distinct species but says that it is distinguished only by the horned sepals. Also the lobes of the leaves are much longer than in the type of *P. cupiformis,* being as long or longer than the undivided portion of the limb and ovate to nearly lanceolate.

THYMELAEACEAE[1]

Daphne Feddei Léveillé. — Rehder in Jour. Arnold Arb. **15:** 105 (1934). — Handel-Mazzetti, Symb. Sin. **7:** 588 (1933).

Handel-Mazzetti does not cite *D. Martini* Lévl. as a synonym.

ELAEAGNACEAE

Elaeagnus umbellata Thunberg, Fl. Jap. 66, t. 44 (1784).

Elaeagnus Argyi Léveillé in Fedde, Rep. Spec. Nov. **12:** 101 (1913); in Mem. Acad. Ci. Art. Barcelona, ser. 3, **12:** 550 (Cat. Pl. Kiang-Sou, 10) (1916).

Elaeagnus coreanus Léveillé in Fedde, Rep. Spec. Nov. **12:** 101 (1913).

Elaeagnus umbellata var. *coreana* (Lévl.) Léveillé, Cat. Pl. Yun-Nan, 83 (1916).

Elaeagnus crispa Thunb. var. *parvifolia* (Royle) Nakai, Fl. Sylv. Kor. **17:** 11 (1928).

Korea. Quelpaert: Fusan, *U. Faurie,* no. 986 in 1906; no. 2009 in 1907, *E. Taquet,* nos. 1359–1362, 3187–3190, 5936, 5937 in 1908–1911 (in herb. Léveillé, sub *E. coreanus;* syntypes; isotypes of Faurie's nos. 1359–1362, 3187–3190 and of Taquet no. 2009 in A. A.).

China. Kiangsu: Zuo-se; Pou-si; montagnes, *Ch. d'Argy* [1844–66] (holotype of *E. Argyi;* isotype in A. A.). Yunnan: haies de la plaine à Tong-tchouan, alt. 2500 m., *E. E. Maire,* Apr. [1912–14] (in herb. Léveillé sub *E. coreanus;* duplicate in A. A.).

The Korean specimens have the leaves mostly elliptic oblong and not exceeding 4 cm. in length. The different branches under *E. Argyi* vary greatly in size and shape of leaves, from oblong and 3 × 1 cm. long to elliptic and 8 cm. long and nearly 5 cm. wide. Specimens with leaves of similar size and shape are Herb. Univ. Nanking, nos. 582 and 14479 (C. Y. Chiao). The Yunnan specimen does not differ from the Korean specimens.

Léveillé does not cite any numbers with the description of *E. coreanus* and none of the specimens in his herbarium are labeled *E. coreanus,* but all the specimens from Korea cited above, are in the Léveillé herbarium in covers labeled *E. coreanus.*

NYSSACEAE[2]

Camptotheca acuminata Decaisne in Bull. Soc. Bot. France, **20:** 157 (1873).

Cephalanthus Esquirolii Léveillé in Fedde, Rep. Spec. Nov. **13:** 176 (1914); Fl. Kouy-Tchéou, 365 (1915).

[1]See Vol. **15:** 103.
[2]See Vol. **15:** 107.

China. K w e i c h o u : bois, route de Pin-fa à Tou-yun, ça et la, *J. Cavalerie*, no. 2963, Aug. 1908 (holotype; isotype in A. A.).

The species is represented in this herbarium from Kweichou also by Y. Tsiang no. 6286.

MELASTOMACEAE[1]

Sarcopyramis napalensis Wallich, Tent. Fl. Napal. 32, t. 23 (1826). — Guillaumin in Bull. Soc. Bot. France, **60**: 343 (1913).

Sarcopyramis Bodinieri Léveillé & Vaniot in Mem. Soc. Nat. Sci. Nat. Cherbourg, **35**: 397 (1906); in Fedde, Rep. Spec. Nov. **4**: 95 (1907).

Sarcopyramis nepalensis var. *Bodinieri* (Lévl. & Vant.) Léveillé, Fl. Kouy-Tchéou, 278 (1914).

China. K w e i c h o u : environs de Kouy-yang, bois de Kien-lin-chan, talus moussus, *E. Bodinier*, no. 2393, July 7, 1898, "jolies fleurs roses" (holotype of *S. Bodinieri;* photo. in A. A.); environs de Tou-chan, *J. Cavalerie* in herb. Bodinier, no. 2674, July 1899; Pin-fa, *J. Cavalerie*, nos. 47, 249, July 15 and June 28, 1902 (cited in Fl. Kouy-Tchéou under *Sarcopyramis nepalensis* var. *Bodinieri*).

Guillaumin (l. c.) refers *S. Bodinieri* to *S. napalensis* as a smaller and weaker form with small leaves. Probably on the strength of Guillaumin's remarks, Léveillé reduced his species in 1914 to a variety of *S. napalensis*. The type sheet of *S. Bodinieri* contains four specimens with small more or less colored leaves and above a specimen with larger green leaves, and bears besides the identification label of Guillaumin, also a note by Diels stating that only the smaller specimens below agree with Léveillé's description, while the upper specimen is *S. nepalensis*. The other collections cited in Flore du Kouy-Tchéou are partly intermediate between the two forms.

Phyllagathis Cavaleriei (Lévl. & Vant.) Guillaumin in Not. Syst. Paris, **2**: 325 (1913); in Bull. Soc. Bot. France, **60**: 273 (1913). — Rehder in Jour. Arnold Arb. **14**: 113 (1934). — Handel-Mazzetti in Beih. Bot. Centrbl. **52B**: 163 (Pl. Mell. Sin.) (1934).

Handel-Mazzetti (l. c.) records this species from Kwangtung (Mell 390, 637).

ARALIACEAE[2]

Dendropanax morbiferus Léveillé in Fedde, Rep. Spec. Nov. **8**: 263 (1910), *"D. morbiferum."*

Gilibertia morbifera (Lévl.) Nakai in Jour. Arnold Arb. **5**: 22 (1924).

[1]See Vol. 15: 109.
[2]See Vol. 15: 113.

Textoria morbifera (Lévl.) Nakai, Fl. Sylv. Kor. **16**: 41, t. 12, 13 (1927).

KOREA. Quelpaert: secus torrentes, *U. Faurie,* no. 547, Oct. 1906, "arbre qui donne la gale;" circa Hongno, *U. Faurie,* no. 1663, July 1907; in sylvis, *E. Taquet,* nos. 895, 896, Sept. 4 and 2, 1908, "l'attouchement de l'arbre provoque des eruptions; sa sève donne un bon vernis;" *E. Taquet,* no. 183 (syntypes of *Dendropanax morbiferum;* isotypes of Faurie 547 and 1663 and photo. of 547, isotypes of Taquet 895 and 896 and photo. of 895 in A. A.; Taquet 183 not seen).

This species is very close to the Japanese *D. trifidus* (Thunb.) Makino and seems to differ chiefly in the smaller ellipsoid fruit (8 × 6 mm.) subglobose and larger (10 × 9) in *D. trifidus,* in the shorter pedicels (4–6 mm.), 8–10 mm. in *D. trifidus.* According to Nakai (1924, l. c.) the Korean species yields a yellow lacquer much used in Korea, while the Japanese species contains a colorless resin. The leaves are almost indistinguishable, but in the Japanese species they seem to be more distinctly and more abruptly acuminate and more frequently lobed with the lobes distinctly acuminate.

The generic name *Gilibertia* is invalidated by the older homonym *Gilibertia* J. G. Gmelin (1791), and *Dendropanax* Dcne. & Planch. has to take its place for the American and Asiatic species, but Nakai (1927, l. c.) revives *Textoria* Miq. for the species of Eastern Asia, distinguished from the American species chiefly by the inflorescence consisting of a simple umbel.

CLETHRACEAE[1]

Clethra Bodinieri Léveillé. — Handel-Mazzetti in Sinensia, **5**: 3 (Aug. 1934). — Rehder in Jour. Arnold Arb. **15**: 267 (Oct. 1934).

Handel-Mazzetti (l. c.) refers to this species also R. C. Ching, nos. 5734 and 5804 from Kwangsi.

Clethra Cavaleriei Léveillé. — Rehder in Jour. Arnold Arb. **15**: 267 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 760 (1936).

Handel-Mazzetti (l. c.) records this species also from Hunan (no. 12397), from Fukien (Chung 2923 and Ching 2300) and from Chekiang (Ching 2101); it is also represented in this herbarium from Kwangtung (Mell 883; det. Handel-Mazzetti).

Clethra kaipoensis Léveillé. — Rehder in Jour. Arnold Arb. **15**: 268 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 760 (1936).

[1]See Vol. **15**: 267.

ERICACEAE[1]

Rhododendron denudatum Léveillé. — W. W. Smith & Tagg in Jour. Arnold Arb. **15**: 269 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 780 (1936).

Handel-Mazzetti refers to this species two specimens of his from Szechuan (nos. 1471, 1666) and Maire (Arn. Arb. 494) from Yunnan.

Rhododendron irroratum Franchet in Bull. Soc. Bot. France, **34**: 280 (1887). — Handel-Mazzetti, Symb. Sin. **7**: 779 (1936).

Rhododendron Maximowiczianum Léveillé. — W. W. Smith & Tagg in Jour. Arnold Arb. **34**: 278 (1934).

Handel-Mazzetti (l. c.) refers *R. Maximowiczianum* as a synonym to *R. irroratum*.

Rhododendron rex Léveillé. — W. W. Smith & Tagg l. c. 270 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 783 (1936).

Handel-Mazzetti refers to this species three specimens of his from Szechuan (nos. 921, 1394, 1472).

Rhododendron coeruleum Léveillé. — W. W. Smith & Tagg, l. c. 273 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 773 (1936).

Handel-Mazzetti cites under this species his no. 6237 and Cavalerie no. 4629 from Yunnan and his nos. 2153, 2403 and Schneider 4107.

Rhododendron Duclouxii Léveillé (*R. spiciferum* × *spinuliferum*) Handel-Mazzetti, Symb. Sin. **7**: 775 (1936).

Rhododendron spinuliferum "Franchet" ex Tagg in Rhodod. Soc. Notes **3**: 228 (1928). — Hutchinson in Spec. Rhodod. 606 (1930), quoad synon. *R. Duclouxii*. — W. W. Smith & Tagg in Jour. Arnold Arb. **15**: 274 (1934), quoad synon. *R. Duclouxii*. — Non Rh. *spinuliferum* Franch.

Handel-Mazzetti describes as this hybrid his no. 8621 which he states agrees with the type of *R. Duclouxii;* he also refers here Maire nos. 1119 and 1122 in herb. Berlin.

Rhododendron Bachii Léveillé. — W. W. Smith & Tagg, l. c. 275 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 771 (1936).

Handel-Mazzetti refers to this species his no. 11077, his Pl. Sin. 4 from Hunan, and his Pl. Sin. 145 from Kiangsi.

Rhododendron Esquirolii Léveillé. — Tagg in Spec. Rhodod. 853 (1930). — W. W. Smith & Tagg, l. c. 276 (1934).

Rhododendron Vaniotii Léveillé in Fedde, Rep. Spec. Nov. **13**: 148 (1914).

[1]See Vol. **15**: 269.

CHINA. K w e i c h o u : Gan-chouen, *J. Esquirol,* no. 3886, April (Nov. on label) 1912, "fl. rose-violet" (holotype of *R. Vaniotii;* photo. in A. A.).

Tagg (l. c.) refers *R. Vaniotii* to *R. Esquirolii.* The type specimen in herb. Léveillé bears only the name *R. Esquirolii* in Léveillé's handwriting on the original label. Neither name appears in the Flore du Kouy-Tchéou.

Rhododendron chrysocalyx Léveillé. — W. W. Smith & Tagg, l. c. 276 (1934).

Rhododendron kouytchense Léveillé, Fl. Kouy-Tchéou, 152 (1914), pro synon. *R. chrysocalycis.*

The type of *R. kouytchense* which appears only in the synonymy of *R. chrysocalyx* is apparently an unnamed specimen without number, collected by Bodinier at Lan-uen, May 1900 (photo. in A. A.) cited under *R. chrysocalyx* in Flore du Kouy-Tchéou.

Enkianthus Dunnii Léveillé. — Rehder in Jour. Arnold Arb. **15:** 278 (1934). — Fang in Contr. Biol. Lab. Sci. Soc. China, **10:** 18 (1936).

Fang enumerates *E. Cavaleriei* and *E. xanthoxanthus* of Léveillé as synonyms of this species.

Enkianthus chinensis Franchet. — Rehder, l. c. 279 (1934). — Fang, l. c. 24 (1935).

Fang cites *Zenobia cerasiflora, Enkianthus cerasiflorus* and *Bodinierella Cavaleriei* of Léveillé among the synonyms of this species.

Leucothoë Griffithiana Clarke in Hook. f. Fl. Brit. Ind. **3:** 460 (1882).

Pieris Cavaleriei Léveillé. — **Synon. nov.**

Leucothoe spec. Rehder in Jour. Arnold Arb. **15:** 280 (1934).

Since I referred *Pieris Cavaleriei* to *Leucothoë* as "L. spec." I had the opportunity to see the type of *L. Griffithiana* at Kew and find that the calyx-teeth of that species are triangular-ovate and acute and do not differ from those of *Pieris Cavaleriei* except that the latter show a tendency to be short-acuminate; the leaves also agree in shape and size, except that those of the latter are mostly rounded or nearly so at base and are more distinctly denticulate and the veinlets beneath indistinct. Specimens from Yunnan (Rock 11520, 22036 and 22479) agree in leaf shape and serration more closely with the type.

Lyonia ovalifolia (Wall.) Drude in Engler & Prantl, Nat. Pflanzenfam. IV. **1:** 44 (1897).

Pieris Ulbrichii Léveillé.

Pieris Mairei Léveillé.
Vaccinium Mairei Léveillé.
Xolisma ovalifolia (Wall.) Rehder in Jour. Arnold Arb. **5**: 52 (1924); **15**: 281 (1934).

Since *Lyonia* Nutt. has been accepted as a nomen conservandum in 1935, *Xolisma* Raf. becomes a synonym of *Lyonia*.

Lyonia ovalifolia var. **lanceolata** (Wall.) Handel-Mazzetti, Symb. Sin. **7**: 281 (1936).

Pieris kouyangensis Léveillé.
Pieris Mairei var. *parvifolia* Léveillé.
Xolisma ovalifolia var. *lanceolata* (Wall.) Rehder in Jour. Arnold Arb. **5**: 52 (1924); **15**: 281 (1934).

Lyonia villosa (Wall.) var. **pubescens** (Franch.), comb. nov.

Pieris Henryi Léveillé.
Xolisma villosa (Wall.) Rehd. var. *pubescens* (Franch.) Rehder in Jour. Arnold Arb. **5**: 53 (1924); **15**: 281 (1934).

Vaccinium mandarinorum Diels var. **austrosinense** (Hand.-Mazz.) Metcalf in Jour. Arnold Arb. **12**: 274 (1931). — Handel-Mazzetti, Symb. Sin. **7**: 795 (1936).

Pieris longicornu Léveillé & Vaniot in Bull. Soc. Bot. France, **51**: 291 (1904); **53**: 206 (1906). — Léveillé, Fl. Kouy-Tchéou, 149 (1914).
Vaccinium Donianum Wight ex Handel-Mazzetti in Anz. Akad. Wiss. Wien, 1925, p. 146 (Pl. Nov. Sin. Forts. 35, p. 4 (1925), quoad syn. *Pieris longicornu* Lévl.
Vaccinium mandarinorum "Diels" ex Rehder in Jour. Arnold Arb. **15**: 284 (1934), quoad synon. *V. longicornu* Lévl.

Handel-Mazzetti referred in 1925 (l. c.) *Pieris longicornu* as a synonym to *V. Donianum* = *V. mandarinorum*, but in 1936 (l. c.) he is inclined to refer it to *V. mandarinorum* var. *austrosinense* chiefly on account of the long staminal appendages.

Vaccinium Duclouxii (Lévl.) Handel-Mazzetti. — Rehder in Jour. Arnold Arb. **15**: 284 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 794 (1936).

Pieris Duclouxii Léveillé.

Vaccinium fragile Franch. var. *β* **myrtifolium** Franchet in Jour. de Bot. **9**: 367 (1895). — Léveillé, Cat. Pl. Yun-Nan, 94 (1916). — Handel-Mazzetti, Symb. Sin. **7**: 796 (1936).

Pieris repens Léveillé in Bull. Acad. Intern. Géog. Bot. **12**: 252 (1903); in Bull. Soc. Bot. France, **53**: 205 (1906); Fl. Kouy-Tchéou, 150 (1914); Cat. Pl. Yun-Nan, 87 (1916).
Vaccinium repens (Lévl.) Rehder in Jour. Arnold Arb. **15**: 283 (1934), excl. syn. *V. mekongense* W. W. Sm.

Handel-Mazzetti has identified *Pieris repens* with *V. fragile* var. *myrtifolium* and this identification is evidently correct. *Vaccinium mekongense,* though very similar in most of its characters to *Pieris repens* differs from it and from *V. fragile* var. *myrtifolium* in its awnless anthers and must be kept as a distinct species.

MYRSINACEAE[1]

Ardisia crispa (Thunb.) De Candolle in Trans. Linn. Soc. **17**: 124 (1834), quoad syn. *Bladhia crispa.*

Ardisia hortorum Maximowicz in Gartenfl. **14**: 363 (1865). — Handel-Mazzetti, Symb. Sin. **7**: 756 (1936).

Ardisia Dielsii Léveillé in Fedde, Rep. Spec. Nov. **9**: 461 (1911); Fl. Kouy-Tchéou, 262 (1914); Cat. Pl. Yun-Nan, 177 (1916).

Ardisia Henryi Hemsl. var. *Dielsii* (Lévl.) Walker in Jour. Arnold Arb. **15**: 290 (1934).

Handel-Mazzetti identifies *A. Dielsii* with *A. hortorum* and the type of *Bladhia crispa* Thunb. which he has seen, and discusses in detail (l. c.) the synonymy and relationship of this and related species. Though he recognizes the identity of *Bladhia crispa* with *A. hortorum,* he does not take up *A. crispa* (Thunb.) DC. for this species, but calls *A. crispa* a nomen confusum and uses *A. hortorum* for *A. crispa* (Thbg.) DC. as to the name bringing synonym and *A. crenata* for *A. crispa* DC. as to the description.

Embelia oblongifolia Hemsley. — Walker in Lingnan Sci. Jour. **10**: 475 (1931); in Jour. Arnold Arb. **15**: 291 (1934).

Embelia Bodinieri Lévl. had been already identified as a synonym of *E. oblongifolia* by Walker in 1931, a reference not cited by him in 1934.

PRIMULACEAE[2]

Lysimachia capillipes Hemsl. var. **Cavaleriei** (Lévl.) Handel-Mazzetti in Jour. Arnold Arb. **15**: 294 (1934); Symb. Sin. **7**: 731 (1936).

Andrachne Cavaleriei Léveillé.

Lysimachia Millietii (Lévl.) Handel-Mazzetti, Symb. Sin. **7**: 731 (1936).

Andrachne Millietii Léveillé in Bull. Géog. Bot. **24**: 146 (1914); Fl. Kouy-Tchéou, 158 (1914).

CHINA. Kweichou: Hin-y-fou, *J. Cavalerie,* no. 3992, June 1912, "fl. jaunes" (holotype of *Andrachne Millietii;* photo. in A. A.).

[1]See Vol. **15**: 288.
[2]See Vol. **15**: 293.

Handel-Mazzetti states that this species belongs to the affinity of *L. capillipes* Hemsl. and *L. lancifolia* Craib, but is distinguished by thick glaucous leaves without prominent veins.

EBENACEAE[1]

Diospyros Esquirolii Léveillé. — Rehder in Jour. Arnold Arb. **15:** 294 (1934). — Handel-Mazzetti, Symb. Sin. **7:** 802 (1936).

STYRACACEAE[2]

Pterostyrax Leveillei (Fedde) Chun. — Rehder in Jour. Arnold Arb. **15:** 295 (1934). — Handel-Mazzetti, Symb. Sin. **7:** 805 (1936).

Styrax Cavaleriei Léveillé (1911, non 1907).

Pterostyrax hispidus Sieb. & Zucc. ex W. W. Smith in Not. Bot. Gard. Edinb. **12:** 238 (1920), non Siebold & Zuccarini.

Styrax Argyi Léveillé. — W. W. Smith in Not. Bot. Gard. Edinb. **12:** 237 (1920). — Rehder in Jour. Arnold Arb. **15:** 295 (1934).

Styrax japonicus Siebold & Zuccarini. — W. W. Smith, l. c. 238 (1920). — Rehder, l. c. 295 (1934).

Styrax Bodinieri was published as a synonym of *S. japonicus* already in 1920 (l. c.) by W. W. Smith.

Styrax grandiflorus Griffith. — W. W. Smith, l. c. 235, 238, 239 (1920). — Rehder, l. c. 296 (1934).

Styrax Cavaleriei Lévl. and *S. touchanensis* Lévl. were referred already in 1920 (l. c.) to *S. grandiflorus* by W. W. Smith, the former with some doubt.

SYMPLOCACEAE[3]

Symplocos Ernesti Dunn (1911). — Handel-Mazzetti, Symb. Sin. **7:** 806 (1936).

Symplocos coronigera Léveillé. — Rehder in Jour. Arnold Arb. **15:** 296 (1934).

The name *S. Ernesti* Dunn given to replace *S. Wilsonii* Brand, a later homonym of *S. Wilsoni* Hemsl., is one year older than *S. coronigera*.

OLEACEAE[4]

Jasminum Seguini Léveillé. — Rehder in Jour. Arnold Arb. **15:** 307 (1934). — Handel-Mazzetti, Symb. Sin. **7:** 1014 (1936).

[1]See Vol. 15: 294.
[2]See Vol. 15: 295.
[3]See Vol. 15: 296.
[4]See Vol. 15: 302.

Jasminum Prainii Léveillé. — Rehder, l. c. 308 (1934).

Ophiorrhiza Esquirolii Léveillé in Fedde, Rep. Spec. Nov. **13**: 177 (1914); Fl. Kouy-Tchéou, 370 (1915). — **Synon. nov.**

CHINA. Kweichou: *J. Esquirol*, no. 437, June 1905 (holotype of *O. Esquirolii;* photo. in A. A.).

The type of *J. Prainii* was collected in fruit by J. Cavalerie between Pin-fa and Ou-glan; the type of *Ophiorrhiza Esquirolii* is in flower.

LOGANIACEAE[1]

Buddleia officinalis Maximowicz in Bull. Acad. Sci. St. Pétersb. sér. 3, **26**: 496; in Mél. Biol. **10**: 675 (1880). — Handel-Mazzetti, Symb. Sin. **7**: 948 (1936).

Buddleia acutifolia C. H. Wright. — Rehder in Jour. Arnold Arb. **15**: 310 (1934).

Handel-Mazzetti refers *B. acutifolia* C. H. Wright as a synonym to *B. officinalis*, and I agree with him that the differences given by Marquand are too slight to maintain the two as distinct species. When describing *B. acutifolia*, the author, C. H. Wright, did not compare it with *B. officinalis* but only with *B. Davidii* Franch. which is a very different species. Handel-Mazzetti also cites *B. Mairei* Lévl. as one of the synonyms of *B. officinalis*.

Buddleia tibetica W. W. Sm. var. **truncatifolia** (Lévl.) Marquand. — Comber in Not. Bot. Gard. Edinb. **18**: 230 (1934). — Rehder in Jour. Arnold Arb. **15**: 310 (1934).

Buddleia truncatifolia Léveillé.

Handel-Mazzetti (Symb. Sin. **7**: 947, 1936) refers *B. truncatifolia* Lévl. and *B. tibetica* W. W. Sm. to *B. crispa* Benth. as synonyms. I have seen too little material of *B. crispa* from its type region to form a definite opinion on the relationship of these species.

APOCYNACEAE[2]

Melodinus Hemsleyanus Diels in Bot. Jahrb. **29**: 539 (1900). — Tsiang in Sunyatsenia, **3**: 130 (1936).

Trachelospermum Esquirolii Léveillé, Fl. Kouy-Tchéou, 32 (1912).

Melodinus khasianus "Hook. f." ex Woodson in Jour. Arnold Arb. **15**: 313 (1934); in Sunyatsenia, **3**: 101 (1936); non Hook. f.

The distinguishing characters of this species, *M. khasianus* and the following species are discussed at length by Tsiang (l. c.).

[1]See Vol. **15**: 309.
[2]See Vol. **15**: 310.

Melodinus Seguini Léveillé. — Woodson in Jour. Arnold Arb. **15:** 313 (1934). — Tsiang in Sunyatsenia, **3:** 131 (1936). — Handel-Mazzetti, Symb. Sin. **7:** 989 (1936).

Carissa Carandas Linnaeus, Mant. **1:** 52 (1767). — Tsiang l. c. 122 (1936).

Damnacanthus Esquirolii Léveillé.
Arduina Carandas K. Schumann. — Woodson, l. c. 312 (1934).

Alstonia yunnanensis Diels. — Woodson, l. c. 315 (1934). — Tsiang, l. c. 138 (1936).

Acronychia Esquirolii Léveillé.
Alstonia Esquirolii Léveillé.

Alstonia Mairei Léveillé. — Woodson, l. c. 315 (1934). — Tsiang, l. c. 138 (1936).

Wikstroemia Hemsleyana Léveillé.
Tsiang refers *A. paupera* Hand-Mazz. to this species as a synonym.

Alyxia Schlechteri Léveillé. — Tsiang in Sunyatsenia, **2:** 105 (1934); **3:** 136 (1936). — Woodson in Jour. Arnold Arb. **15:** 316 (1934).

Daphne Bodinieri Léveillé.
Wikstroemia Bodinieri Léveillé.
Alyxia Bodinieri (Lévl.) Woodson in Jour. Arnold Arb. **15:** 316 (1934).

Ecdysanthera rosea Hooker & Arnott, Bot. Beechey Voy. 198, t. 42 (1836).

Antirrhaea Esquirolii Léveillé, Fl. Kouy-Tchéou, 364 (1915). — **Synon. nov.**

China. Kweichou: locality illegible, *J. Esquirol*, no. 867, "fleur rouge" (holotype of *Antirrhaea Esquirolii;* photo. and isotype in A. A.).

The original label is badly torn and partly illegible, only the collector's name and number and "fleur rouge" are clear; the locality is indistinct and Léveillé in his original description cites neither locality, nor collector or number. On another label the name *Antirrhaea Martini* appears in his handwriting, while by another hand the name *Antirrhaea Esquirolii* is written on the sheet. The latter is evidently the correct name, for it agrees with Léveillé's description. The species was determined as *E. rosea* by Dr. R. E. Woodson, to whom I had sent the material when I found that the plant belonged to the Apocynaceae and not to the Rubiaceae.

Trachelospermum gracilipes Hook. f. — Woodson, l. c. 311 (1934); in Sunyatsenia, **3**: 91 (1936). — Tsiang in Sunyatsenia, **3**: 144 (1936).

Melodinus Cavaleriei Léveillé in Fedde, Rep. Spec. Nov. **2**: 113 (1906) tantum quoad specimen citatum "Lo-pie" aut "Tou-chan" (specim. glabratum), descript. exclusa.

Trachelospermum rubrinerve Léveillé, Fl. Kouy-Tchéou, 32 (1914), sensu synon. praeced.

Trachelospermum gracilipes var. *Cavaleriei* Schneider in Sargent, Pl. Wilson. **3**: 332 (1916), synon. excludendis et specim. "Kouy-yang" et "Lo-pie" aut "Tou-chan" excludendis. — Tsiang in Sunyatsenia, **2**: 137 (1934), sensu Schneider.

CHINA. Kweichou: "Lo-pie, *J. Seguin* in herb. *Bodinier*," or "Tou-chan, *J. Cavalerie*" (see remarks below and citations under *T. Dunnii*.)

The fragments of *T. rubrinerve* Lévl. (*Melodinus Cavaleriei* Lévl.) sent by Léveillé in 1916 without any further data to the Arnold Arboretum and referred by Schneider to *T. gracilipes*, probably were taken from one of the two specimens labeled *Melodinus Cavaleriei* representing two collections, one from "Lo-pie, Avril 1898, J. Seguin [herb.] E. Bodinier," and one from "Tou-chan, J. Cavalerie, June 3, 1899"; one of these specimens belongs to *T. gracilipes* and the other to *T. Dunnii* Lévl., but which is which is not possible to say since the data for both specimens are written on a single label. The fragments were evidently taken from the specimen on the upper left hand corner of the mounted sheet with which they agree, also the strip of bark adhering to the base of the petiole of the leaf sent, corresponds to the partly torn off bark at the base of that branchlet.

Schneider unfortunately took the fragments sent by Léveillé as *T. rubrinerve*, for the type of that species, though he was aware that they did not agree with Léveillé's description of *Melodinus Cavaleriei* for which *T. rubrinerve* is only a new name created by Léveillé because he published at the same place a new species as *T. Cavaleriei*, which has been identified by Tsiang with *Cryptolepis Buchanani* Roem. & Schult. (see p. 239). Schneider further complicated the matter by using "Cavaleriei" as the epithet for a new variety of *T. gracilipes* Hook. f. and based it on Wilson no. 2341 as the type, a procedure clearly against the rules of nomenclature, because by citing *Melodinus Cavaleriei* as the name bringing synonym, the type of that species automatically becomes the type of this new variety and there could be no other type. If the plant described by Schneider as *T. gracilipes* var. *Cavaleriei* is maintained as a distinct variety, it should receive another name and be based on Wilson 2341 as the type.

Trachelospermum Bodinieri (Lévl.) Woodson, l. c. (1934); in Sunyatsenia, **3**: 77 (1936). — Tsiang in Sunyatsenia, **3**: 145 (1936). — Handel-Mazzetti, Symb. Sin. **7**: 990 (1936).

Melodinus Bodinieri Léveillé.

Trachelospermum axillare Hooker f. — Woodson, l. c. (1934); in Sunyatsenia, **3**: 99 (1936). — Tsiang in Sunyatsenia, **2**: 148, fig. 16 (1934); **3**: 145 (1936).

Melodinus Chaffanjoni Léveillé.
Periploca astacus Léveillé.
Maesa scandens Léveillé.

Trachelospermum Dunnii (Lévl.) Léveillé. — Woodson, l. c. (1934); in Sunyatsenia, **3**: 98 (1936). — Tsiang in Sunyatsenia, **2**: 152, fig. 19 (1934); **3**: 148 (1936). — Handel-Mazzetti, Symb. Sin. **7**: 991 (1936).

Melodinus Cavaleriei Léveillé in Fedde, Rep. Spec. Nov. **2**: 113 (1906), excl. specim. citatum "Lo-pie" aut "Tou-chan."
Melodium Dunnii Léveillé, op. cit. **9**: 453 (1911).
Melodinus Dunnii Léveillé, Fl. Kouy-Tchéou, 31 (1914), pro synon. *T. Dunnii.*
Trachelospermum rubrinerve Léveillé, l. c. 32 (1914), pro parte.

China. K w e i c h o u : environs de Kouy-yang, mont du Collége, rare, *J. Chaffanjon,* April 25, 1898 (syntype of *Melodinus Cavaleriei,* cited in Fl. Kouy-Tchéou under *T. Dunnii* and under *T. rubrinerve;* photo. in A. A.); environs de Lo-pie, *J. Seguin* in herb. Bodinier, April 1898; environs de Tou-chan, *J. Cavalerie,* June 3, 1899 (two branches mounted on one sheet with one label; one of the branches is a syntype of *M. Cavaleriei,* the other belongs to *T. gracilipes*); without locality and date, *J. Cavalerie* (holotype of *Melodium Dunnii;* merotype in A. A.); Pin-fa, bois, liane, *J. Cavalerie,* no. 344, Aug. 31, 1902; Pin-fa, bois de Si-tcheou-gai, rare, *J. Cavalerie,* no. 558, Sept. 29, 1902 (both cited under *T. Dunnii* in Fl. Kouy-Tchéou; photos. in A. A.).

Melodinus Cavaleriei and *Melodinus* (*Melodium*) *Dunnii* are conspecific, though they are treated in Flore du Kouy-Tchéou as distinct species under *Trachelospermum* and appear in the key under different divisions. In comparing the original descriptions, one can detect no essential difference, and the specimens cited, which are partly in fruit and partly in flower, are identical, except one branch mounted on a sheet together with a branch of *T. Dunnii;* that branch belongs to *T. gracilipes* and has given rise to considerable confusion discussed under *T. gracilipes.*

Aganosma cymosa (Roxb.) G. Don. — Woodson, l. c. (1934); in Sunyatsenia, **2**: 102 (1936). — Handel-Mazzetti, Symb. Sin. **7**: 991 (1936).

Aganosma Schlechterianum Léveillé in Fedde, Rep. Spec. Nov. **9**: 325 (1911); Fl. Kouy-Tchéou, 40 (1914), "Schlechteriana."

Trachelospermum Navillei Léveillé.

CHINA. K w e i c h o u : rochers à Lao-ten, *J. Esquirol,* nos. 100, 915, June 1904 and July 1906 (syntypes of *Aganosma Schlechterianum;* photos. in A. A.); Lo hou, buissons, alt. 900 m., *J. Esquirol,* no. 3653, June 1912 (holotype of *Trachelospermum Navillei;* photo. and merotype in A. A.)

In his Flore du Kouy-Tchéou Léveillé enumerates under *Aganosma Schlechteriana* (p. 40) an additional specimen in fruit, Esquirol 3765, June 1912, from Tong-tcheou. This specimen, however, has a short ellipsoid fruit, very different from the long cylindrical fruit of *A. cymosa,* and has been referred, though with some doubt, to *Melodinus fusiformis* Champ. by Tsiang (in Sunyatsenia, **3**: 132. 1936).

Sindechites Henryi Oliver in Hooker, Ic. Pl. **18**: t. 1772 (1888). — Tsiang in Sunyatsenia, **3**: 151 (1936). — Handel-Mazzetti, Symb. Sin. **7**: 992 (1936).

Parameria Esquirolii Léveillé.

Sindechites Esquirolii (Lévl.) Woodson in Jour. Arnold Arb. **15**: 316 (1936).

Antirrhaea Martini Léveillé in Fedde, Rep. Spec. Nov. **13**: 178 (1914); Fl. Kouy-Tchéou, 364 (1915). — **Synon. nov.**

CHINA. K w e i c h o u , add: environs de Gan-pin, rochers près de la ville, *L. Martin* in herb. *Bodinier,* no. 2300, June 5, 1898, "bout de corolle jaunâtre"; Pin-fa, *J. Cavalerie,* no. 1025, June 3, 1903, "fl. blanc-jaunes (fourrés)" (syntypes of *Antirrhaea Martini;* photos. in A. A.).

Antirrhaea Martini was determined as *S. Esquirolii* by Dr. R. E. Woodson to whom I sent the material after finding that the plant belonged to the Apocynaceae, but *S. Esquirolii* is considered as not specifically distinct by Y. Tsiang (l. c.) with whom I agree.

Wrightia Schlechteri Léveillé in Fedde, Rep. Spec. Nov. **11**: 67 (1912); Fl. Kouy-Tchéou, 32 (1914).

CHINA. K w e i c h o u : ruisseau de La-jong, *J. Esquirol,* no. 111, June 1904 (holotype; ex Léveillé).

I have seen no specimen of this species but Mr. Y. Tsiang enumerates it as correctly named in a manuscript list he kindly sent me nearly two years ago. Esquirol, no. 3723, bois de La-thing, enumerated in Flore du Kouy-Tchéou (p. 32) under *W. Schlechteri,* he cites with a question mark, and 1797 enumerated by Léveillé on the same page as a doubtful Apocynacea, he cites as "*Wrightia Schlechteri* Lévl.?"

ASCLEPIADACEAE[1]

Cryptolepis Buchanani Roemer & Schultes, Syst. **4**: 409 (1819). — Tsiang in Sunyatsenia, **3**: 160 (1936).

Trachelospermum Cavaleriei Léveillé, Fl. Kouy-Tchéou, 31 (1914). "Cavaleri" — Woodson in Jour. Arnold Arb. **15**: 316 (1934); in Sunyatsenia, **3**: 101 (1936).

Wrightia spec. Woodson in Sunyatsenia, **3**: 101 (1936).

China. Kweichou: ouest de Lo-fou, pente de rivière, *J. Cavalerie*, no. 2643, Nov. 1905 "liane à suc abondant (holotype of *Trachelospermum Cavaleriei;* photo. and merotype).

By Woodson *Trachelospermum Cavaleriei* was referred in 1936 (l. c.) to *Wrightia*, but Tsiang identified it with *Cryptolepis Buchanani*.

Cynanchum caudatum (Miq.) Maximowicz in Bull. Acad. Sci. St. Pétersb. **23**: 275 (Mél. Biol. **9**: 808) (1877). — Handel-Mazzetti, Symb. Sin. **7**: 996 (1936).

Tylophora Cavaleriei Léveillé, Fl. Kouy-Tchéou, 44 (1914).

Cynanchum Boudieri Léveillé & Vaniot in Bull. Soc. Bot. France, **51**: cxliv (1904). — **Synon. nov.**

China. Kweichou: Pin-fa, ruisseau de In-chang, *J. Cavalerie*, no. 620, Oct. 1902 (holotype of *C. Boudieri* and *Tylophora Cavaleriei;* teste Y. Tsiang).

As Mr. Y. Tsiang who has seen the type, writes me, neither name appears on the sheet; the specimen itself consists only of two young follicles and four pairs of young leaves and represents apparently the common *C. caudatum* Maxim. *Cynanchum caudatum* Vellozo, Fl. Flum. Icon. **3**: t. 77 (1827); Fl. Flum. 114 (1881) cannot invalidate Maximowicz's name since the plate published 1827 does not have analyses showing essential characters, and the description was not published until 1881.

Cynanchum Mooreanum Hemsley in Jour. Linn. Soc. Bot. **26**: 108 (Ind. Fl. Sin. 2) (1889).

Tylophora Argyi Schter. ex Léveillé in Mem. Acad. Ci. Art. Barcelona, ser. 3, **12**: 544 (Cat. Pl. Kiang-Sou, 4) (1916), nomen, pro parte.

Cynanchum tylophoroideum Schter. ex Léveillé, l. c. (1916), nomen. — **Synon. nov.**

Kiangsu: *Ch. d'Argy*, no. 6 (type of *Tylophora Argyi;* teste Y. Tsiang); without data (type of *C. tylophoroideum;* teste Y. Tsiang).

According to Y. Tsiang, Argy no. 6 bears no name; the other sheet without data is named *C. tylophoroideum* by Schlechter and bears a

[1]See Vol. 15: 317.

description of the plant in French, but apparently no descriptions of either species were published.

Tylophora Leveilleana Schlechter ex Léveillé, Fl. Kouy-Tchéou, 44 (1914), nom. nud. — Tsiang in Sunyatsenia, **3**: 226 (1936).

CHINA. K w e i c h o u : Ouang-mou, *J. Esquirol,* no. 31, July 1904 (holotype of *T. Leveilleana;* ex Léveillé).

Tsiang (l. c.) gives a brief characterization of this species.

Ceropegia Balfouriana Schlechter in Not. Bot. Gard. Edinb. **8**: 18 (1913).

Aristolochia Mairei Léveillé in Bull. Géog. Bot. **22**: 228 (1912); Cat. Pl. Yun-Nan, 13 (1915). — **Synon. nov.**

Aristolochia viridiflora Léveillé in Fedde, Rep. Spec. Nov. **12**: 99 (1913); Cat. Pl. Yun-Nan, 13 (1915). — **Synon. nov.**

Aristolochia viridiflora var. *occlusa* Léveillé l. c. 190 (1913); l. c. (1915). — **Synon. nov.**

Aristolochia Blinii Léveillé, l. c. 287 (1913); l. c. 11, fig. 1 (1915). — **Synon. nov.**

CHINA. Y u n n a n : Tcheou-kia-tse-tang, 2500 m., très rare, *E. E. Maire,* June 1910 (no. 3536 in herb. Bonati, holotype of *Aristolochia Mairei;* photo. in A. A.); La-kou, monts calcaires, 2500 m., *E. E. Maire,* Sept. 1911 (holotype of *A. viridiflora;* ex Léveillé); bois de Kin-tchong-chan, *E. E. Maire* (holotype of *A. viridiflora* var. *occlusa;* ex Léveillé); pâturages des hauts plateaux à Tai-hai, 3200 m., *E. E. Maire,* July 1912 "asclepias vivace, fl. violet sombre, pétales unis au sommet et balounés" (holotype of *A. Blinii;* photo. in A. A.).

The type specimens of *Aristolochia Mairei* and of *A. Blinii* which I have seen, have been labeled by W. W. Smith *Ceropegia* aff. *Balfouriana* Schlecht. Y. Tsiang who had seen these specimens and also *A. viridiflora* states (in litt.) that he agrees with Professor W. W. Smith in this determination.

Tylophora floribunda Miquel in Ann. Mus. Bot. Lugd.-Bat. **2**: 128 (Prol. Fl. Jap. 60) (1866). — Tsiang in Sunyatsenia, **3**: 231 (1936).

Tylophora Argyi Schter. ex Léveillé in Mem. Acad. Ci. Art. Barcelona, ser. 3, **12**: 544 (Cat. Pl. Kiang-Sou, 4) (1916), nomen, pro parte.

CHINA. K i a n g s u : *Ch. d'Argy* [1844–66] (syntypes of *Tylophora Argyi;* ex Léveillé).

There are apparently three specimens under *T. Argyi* in the Léveillé herbarium according to Tsiang's manuscript list; one, "no. 6," is *Cynanchum Mooreanum* Hemsl., the other two unnumbered belong to *T. flori-*

bunda. Tsiang (l. c.) does not cite *T. Argyi* as a synonym, but enumerates a specimen from Kiangsu collected by d'Argy.

Tylophora Dielsii (Lévl.) Hu in Jour. Arnold Arb. **5**: 232 (1924). — Tsiang in Sunyatsenia, **3**: 230 (1936).

Hoyopsis Dielsii Léveillé in Fedde, Rep. Spec. Nov. **13**: 262 (1914). *Tylophora Hoyopsis* Léveillé, Fl. Kouy-Tchéou, 44 (1914).

China. K w e i c h o u : Pin-fa, fourrés précipices, *J. Cavalerie*, no. 1046, June 3, 1903 (holotype of *Hoyopsis Dielsii;* ex Léveillé).

Tsiang states that this species is allied to his *T. Tengii* (p. 228) which is illustrated by a text figure and a plate and accompanied by a detailed description.

Tylophora spec. ?

Dischidia yunnanensis Léveillé, Cat. Pl. Yun-Nan, 14 (1915).

China. Y u n n a n : sous bois de Tcheou-kia-ouan, 2550 m., *E. E. Maire*, Sept. 1911 (holotype of *Dischidia yunnanensis;* ex Léveillé).

Dischidia yunnanensis is referred by Tsiang in his manuscript list doubtfully to *Tylophora*. I have not seen the specimen and it is not enumerated by Tsiang among the 24 species of *Tylophora* recorded from China (in Sunyatsenia, **3**: 216–239).

Dischidia Esquirolii (Lévl.) Tsiang in Sunyatsenia, **3**: 183 (1936).

Hoya Esquirolii Léveillé in Fedde, Rep. Spec. Nov. **11**: 298 (1912); Fl. Kouy-Tchéou, 42 (1914). — Woodson in Jour. Arnold Arb. **15**: 318 (1934).

China. K w e i c h o u : au bac de Pai-ouai, *J. Esquirol*, no. 2801, May 20, 1912, "pend. en long ficelles des rochers et des vieux troncs, fleur blanche;" Lou-fou, *J. Cavalerie*, no. 3484, March 1909, "sur arbre" (syntypes of *Hoya Esquirolii;* photos. in A. A.).

Hoya Lyi Léveillé in Bull. Soc. Bot. France, **54**: 369 (1907); Fl. Kouy-Tchéou, 42 (1914). — Tsiang in Sunyatsenia, **3**: 179 (1936). — Handel-Mazzetti, Symb. Sin. **7**: 1001 (1936), in nota sub *H. yuennanensis*.

Hoya carnosa "R. Br." ex Woodson in Jour. Arnold Arb. **15**: 318 (1934), quoad synon. *H. Lyi;* non (L.) R. Brown.

China. K w e i c h o u : environs de Gan-pin, sur les parois des rochers surplombant une depression en forme de cirque, *L. Martin* in herb. *Bodinier*, Sept. 20, 1897; Lo-pie, rocailles près du marché, *L. Martin* and *J. Seguin*, no. 1853, Oct. 7, 1897; Tsien-sen-kiao, *J. Ly*, no. 1879, Nov. 1904 (syntypes of *H. Lyi;* ex Léveillé).

Marsdenia stenantha Handel-Mazzetti, Symb. Sin. **7**: 1003, t. 13,

fig. 10 (March 1936). — Tsiang in Sunyatsenia, **3**: 202 (May 1936).

Stephanotis yunnanensis Léveillé, Cat. Pl. Yun-Nan, 14 (1915). — Woodson in Jour. Arnold Arb. **15**: 317 (1934).

Léveillé's specific epithet cannot be transferred to *Marsdenia* on account of the older homonym *M. yunnanensis* (Lévl.) Woods. of 1934 which was referred as a synonym to *M. oreophila* W. W. Sm.

Marsdenia oreophila W. W. Smith in Not. Bot. Gard. Edinb. **8**: 193 (1914). — Handel-Mazzetti, Symb. Sin. **7**: 1002 (1936). — Tsiang in Sunyatsenia, **3**: 205 (1936).

Gongronema yunnanense Léveillé, Cat. Pl. Yun-Nan, 13 (1915).

Marsdenia yunnanensis (Lévl.) Woodson in Jour. Arnold Arb. **15**: 317 (1934).

Marsdenia tenacissima (Roxb.) Wight & Arnott in Wight, Contrib. Bot. Ind. 41 (1834). — Tsiang in Sunyatsenia, **3**: 214 (1936).

Metaplexis Cavaleriei Léveillé, Fl. Kouy-Tchéou, 42 (1914).

Marsdenia Cavaleriei (Lévl.) Handel-Mazzetti ex Woodson in Jour. Arnold Arb. **15**: 318 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 1002 (1936).

Heterostemma Esquirolii (Lévl.) Tsiang in Sunyatsenia, **3**: 189 (1936).

Pentasacme Esquirolii Léveillé, Fl. Kouy-Tchéou, 14 (1914).

CHINA. Kweichou: trou du Heou-hay-tse, *J. Esquirol*, no. 716, Aug. 1905; Gan-chouen, *J. Cavalerie*, no. 3973, Aug. 1912 (syntypes of *Pentasacme Esquirolii;* ex Léveillé).

CONVOLVULACEAE[1]

Argyreia Seguini (Lévl.) Vaniot ex Léveillé. — Rehder in Jour. Arnold Arb. **15**: 319 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 813 (1936).

Lettsomia Seguini Léveillé.

This species was collected in Kweichou also by Handel-Mazzetti (no. 10355).

Quamoclit pennata (Desrouss.) Bojer, Hort. Maurit. 224 (1837).

Incarvillea Argyi Léveillé in Bull. Géog. Bot. **24**: 292 (1914); in Mem. Acad. Ci. Art. Barcelona, ser. 3, **12**: 545 (Cat. Pl. Kiang-Sou, 5) (1916); Cat. Ill. Pl. Seu-Tchouen, pl. 4 (1918) ms. — **Synon. nov.**

CHINA. Kiangsu: *Ch. d'Argy* [1844–66] (holotype of *Incarvillea Argyi;* isotype in A. A.).

Incarvillea Argyi was determined by Dr. E. D. Merrill as *Quamoclit pennata* from the isotype in this herbarium.

[1]See Vol. **15**: 318.

BORAGINACEAE[1]

Ehretia acuminata R. Brown, Prodr. Fl. N. Holl. 497 (1810).

Ehretia Argyi Léveillé in Fedde, Rep. Spec. Nov. **11**: 67 (1912); in Mem. Acad. Ci. Art. Barcelona, ser. 3, **12**: 545 (Cat. Pl. Kiang-Sou, 5 (1916). — **Synon. nov.**

China. Kiangsu: *Ch. d'Argy* [1844–66] (holotype of *E. Argyi;* photo. and isotype in A. A.).

Nakai (in Jour. Arnold Arb. **5**: 38. 1924) distinguished the plant of eastern Asia under the name of *E. thyrsiflora* (Sieb. & Zucc.) Nakai from *E. acuminata* R. Br., but I agree with Handel-Mazzetti (Symb. Sin. **7**: 815) that there are no reliable characters by which to separate the two.

VERBENACEAE[2]

Callicarpa Bodinieri Léveillé. — Rehder in Jour. Arnold Arb. **15**: 321 (1934). — Handel-Mazzetti, Symb. Sin. **7**: 900 (1936).

Callicarpa Bodinieri var. **Lyi** (Lévl.) Rehder, l. c. 322 (1934). — Handel-Mazzetti, l. c. (1936).

Callicarpa Lyi Léveillé.

Callicarpa Bodinieri var. **Giraldii** (Rehd.) Rehder, l. c. 322 (1934). — Handel-Mazzetti, l. c. (1936).

Callicarpa Mairei Léveillé.

Premna puberula Pampanini. — Rehder, l. c. 324 (1934). — Handel-Mazzetti, l. c. 905 (1936).

Premna Bodinieri Léveillé.

Caryopteris paniculata C. B. Clarke. — P'ei in Mem. Sci. Soc. China I, no. **3**: 176 (Verben. China) (1932). — Rehder in Jour. Arnold Arb. **15**: 326 (1934).

Callicarpa Esquirolii Léveillé in Fedde, Rep. Spec. Nov. **9**: 325 (1911). — **Synon. nov.**

Callicarpa Martini Léveillé.

China. Kweichou, add: without precise locality, *J. Esquirol,* no. 754 (holotype of *Callicarpa Esquirolii,* cited in Fl. Kouy-Tchéou under *C. Martini;* photo. in A. A.).

P'ei (l. c.) cited *Caryopteris paniculata* C. B. Clarke with the parenthetical author "(Kurz)" which is apparently an error, since *C. paniculata* is a new name, not a new combination, and is based on *Clerodendron gratum* Kurz, not Wall.

[1]See Vol. **15**: 320.
[2]See Vol. **15**: 320.

Esquirol no. 754 cited in Flore du Kouy-Tchéou under *Callicarpa Martini* is the holotype of *C. Esquirolii,* but the type specimen bears only the name *Callicarpa Martini* in Léveillé's handwriting.

LABIATAE[1]

Teucrium palmatum Bentham in Hooker f., Fl. Brit. Ind. **4:** 702 (1885).

Caryopteris Mairei Léveillé, Sert. Yunnan, 3 (1916); Cat. Pl. Yun-Nan, 277, 298 (1917).

CHINA. Yunnan: bords des eaux, haut plateau de Ta-hai, 3200 m., *E. E. Maire,* July 1912, "Labiée vivace, dressé, fl. grises ou roses ou rouges" (holotype of *Caryopteris Mairei;* merotype in A. A.).

Caryopteris Mairei was identified with *Teucrium palmatum* by Dr. E. D. Merrill from the merotype in this herbarium.

Microtoena insuavis (Hance) Prain ex Dunn in Not. Bot. Gard. Edinb. **6:** 188 (1915). — Merrill in Lingnan Sci. Jour. **13:** 46 (1934).

Microtoena mollis Léveillé in Fedde, Rep. Spec. Nov. **9:** 222 (1911).

Microtoena Esquirolii Léveillé l. c. (1911).

CHINA. Kweichou: Lo-fou, *J. Cavalerie,* no. 3548, March 1909; Kiao-tsong, *J. Esquirol,* nos. 155, 330, Dec. 13, 1904 (syntypes *M. mollis;* ex Léveillé); route de Tchen-fong, *J. Esquirol,* no. 672, Oct. 1905 (holotype of *M. Esquirolii;* ex Léveillé).

Microtoena mollis and *M. Esquiroli* are enumerated by E. D. Merrill (l. c.) as synonyms of *M. insuavis.*

Elsholtzia heterophylla Diels in Not. Bot. Gard. Edinb. **5:** 231 (1912). — Léveillé, Cat. Pl. Yun-Nan, 137 (1916).

Pogostemon lavandulaespica Léveillé in Fedde, Rep. Spec. Nov. **13:** 344 (1914).

Elsholtzia lavandulaespica (Lévl.) Léveillé in Bull. Géog. Bot. **25:** 25 (1915).

Elsholtzia Bodinieri Vant. var. *lavandulaespica* (Lévl.) Léveillé, Cat. Pl. Yun-Nan, 137, fig. 28 (1916).

CHINA. Yunnan: plaine stagnante de Lou-pou, alt. 2000 m., *E. E. Maire,* Oct. 1913, "Labiée menthacée annuelle, fl. roses" (holotype of *Pogostemon lavandulaespica;* photo. in A. A.).

The plant figured in Cat. Pl. Yun-Nan is apparently a weak lateral stem, which usually has small elliptic or ovate leaves, while the normal more vigorous stems have oblong-lanceolate or narrow-oblong leaves about 2 cm. long. The species, which is a stoloniferous perennial, some-

[1]See Vol. **16:** 311.

what woody at the base, seems to be fairly common in Yunnan and has been collected by Henry and Forrest.

SOLANACEAE[1]

Solanum verbascifolium Linnaeus, Sp. Pl. 184 (1753). — Léveillé, Fl. Kouy-Tchéou, 403 (1915).

Ficus corymbifera Léveillé & Vaniot in Mem. Acad. Ci. Art. Barcelona, ser. 3, **6**: 149 (Ficus Sp. Chin. 11) (1907); in Fedde, Rep. Spec. Nov. **4**: 67, 83 (1907).

China. Kweichou: Ouang-mou, *J. Esquirol,* no. 137, June 1904 (holotype of *Ficus corymbifera;* photo. in A. A.).

Léveillé & Vaniot state in Fedde, Rep. Spec. Nov. **4**: 67 that according to new material received, the plant described as *Ficus corymbifera* has turned out to be a Solanacea, and in Flore du Kouy-Tchéou, 403, Léveillé enumerates Esquirol 137 under *Solanum verbascifolium* without citing *F. corymbifera* as a synonym.

Solanum Capsicastrum Link ex Schauer in Allg. Gartenzeit. **1**: 228 (1833).

Solanum Dunnianum Léveillé in Fedde, Rep. Spec. Nov. **9**: 324 (1911); Cat. Pl. Yun-Nan, 267 (1917). — **Synon. nov.**

China. Yunnan: jardin de H. Ke-Chou et abondant aux rochers de Ting-mei, *J. Esquirol,* no. 536, June 1905 (holotype of *S. Dunnianum;* photo. in A. A.).

This Brazilian species is frequently cultivated; according to a specimen from Hopei (J. C. Liu, 2061) it is being grown in Peiping as a pot plant. The note on the label "et abondante aux rochers de Ting-mei" may indicate that it has become naturalized in that region, if it refers at all to the same plant.

Solanum cornutum Lamarck, Tabl. Encycl. Méth. **2**: 25 (1793).

Solanum Heudesii Léveillé in Fedde, Rep. Spec. Nov. **11**: 295 (1912).

China. Kiangsu: Chang-hay, jardin des Jesuites à Zi-ka-wei, originaire de l'intérieur de la province, *E. Bodinier,* Aug. 1891 (holotype of *S. Heudesii;* photo. in A. A.).

The specimen agrees well with Mexican specimens of *S. cornutum.*

SCROPHULARIACEAE[2]

Brandisia racemosa Hemsley. — Rehder in Jour. Arnold Arb. **16**: 315 (1935). — Handel-Mazzetti, Symb. Sin. **7**: 831 (1936)..

Deutzia funebris Léveillé.

[1]See Vol. **16**: 314.
[2]See Vol. **16**: 315.

GESNERIACEAE

Rhabdothamnopsis chinensis (Franch.) Handel-Mazzetti, Symb. Sin. **7**: 884 (1936).

Rhabdothamnopsis sinensis Hemsley in Jour. Linn. Soc. Bot. **35**: 517 (1903).

Boea Cavaleriei Léveillé & Vaniot in Compt. Rend. Assoc. Franç. Adv. Sci. **1905**: 429 (1906); in Fedde, Rep. Spec. Nov. **5**: 224 (1908); Fl. Kouy-Tchéou, 180 (1914). — **Synon. nov.**

CHINA. K w e i c h o u : environs de Tou-chan, *J. Cavalerie,* June 2, 1898, "Fleurs bleues: labelle pointillé avec tache blanche, fruit sec en spirale"; route de Pin-yue à Kouy-yang, *L. Martin,* May 18, 1899 (both in herb. *Bodinier* under no. 2347 on one sheet, holotype of *Boea Cavaleriei;* photo. in A. A.).

The type sheet contains two collections, one specimen in fruit collected by Cavalerie, and two specimens in flower collected by Martin. Handel-Mazzetti (l. c.) enumerates an isotype of Léveillé's species, probably from the Paris Herbarium, but does not cite the name *Boea Cavaleriei.* There is also in this herbarium an isotype of no. 2347 from the Paris Herbarium which is dated June 27, 1899 and is identified with the fruiting specimen of the type, with only Bodinier's name as collector. In Flore du Kouy-Tchéou, Léveillé cites Cavalerie & Martin 2056 with the localities as in no. 2347, but does not mention the latter number.

Aeschynanthus spec.

Didymocarpus Cavaleriei Léveillé in Fedde, Rep. Spec. Nov. **9**: 453 (1911); Fl. Kouy-Tchéou, 183 (1914); non Léveillé (1906).

CHINA. K w e i c h o u : ouest de Lo-fou, *J. Cavalerie,* no. 2555, Nov. 1905 (holotype of *Didymocarpus Cavaleriei;* photo. in A. A.).

This species is removed from *Didymocarpus* by its 4 fertile stamens and apparently belongs to *Aeschynanthus,* but does not seem to be referable to any described species. It is characterized by the oblong-lanceolate leaves being minutely pubescent beneath, more densely so on the midrib and veins, and remotely and obscurely denticulate on the margin; the flowers are borne in twos on slender axillary peduncles, the calyx is divided to the base into oval-oblong sepals about 7 mm. long and the corolla is about 4 cm. long.

Lysionotus pauciflorus var. **linearis,** var. nov.

Lysionotus Cavaleriei Léveillé in Fedde, Rep. Spec. Nov. **9**: 328 (1911); Fl. Kouy-Tchéou, 184 (1914); non Léveillé (1909).

CHINA. K w e i c h o u : Pin-fa, rochers, très rare, *J. Cavalerie,* no. 2531, Oct. 11, 1905 (holotype of *L. Cavaleriei;* photo. in A. A.).

This variety is easily distinguished by its linear leaves, scarcely ex-

ceeding 4 mm. in width and 1.5–3.5 cm. long, colored purple or purplish on the under surface; otherwise it seems not different from *L. pauciflorus* Maxim. The peduncles are all subterminal and one-flowered and the fruits are from 3.5–8 cm. long.

The specific epithet of Léveillé's name is invalidated by the older homonym *L. Cavaleriei* Lévl. (in Fedde, Rep. Spec. Nov., **6**: 264. 1909) which judging from the description is not a *Lysionotus;* it was probably transferred to another genus and for that reason could not be located in the Léveillé herbarium.

ACANTHACEAE[1]

Strobilanthes lofouensis Léveillé in Fedde, Rep. Spec. Nov. **12**: 99 (1913); Fl. Kouy-Tchéou, 22 (1914).

China. Kweichou: Lo-fou, *J. Cavalerie,* no. 3288, Apr. 1907, "blanc rouge" (holotype; photo. in A. A.).

This species seems closely related to *S. flaccidifolius* Nees, but is easily distinguished by the entire or nearly entire leaves of firmer texture, by the shorter and narrower acuminate densely pubescent sepals and by the smaller corolla, 2.5–3 cm. long, sparingly villous outside, and more abruptly contracted into a rather short tube. It is a much branched shrub, the branches covered with light grayish brown bark split by longitudinal fissures.

RUBIACEAE[2]

Oldenlandia hedyotidea (DC.) Handel-Mazzetti, Symb. Sin. **7**: 1015 (1936).

Hedyotis Esquirolii Léveillé.

Hedyotis hedyotidea (DC.) Merrill in Lingnan Sci. Jour. **13**: 48 (1934).

Oldenlandia macrostemon (Hook. & Arn.) Kuntze. — Rehder in Jour. Arnold Arb. **16**: 316 (1935).

Wendlandia uvariifolia Hance subsp. **Dunniana** (Lévl.) Cowan. — Rehder in Jour. Arnold Arb. **16**: 318 (1935). — Handel-Mazzetti, Symb. Sin. **7**: 1016 (1936).

Wendlandia Dunniana Léveillé.

Adina rubella Hance in Jour. Bot. **6**: 114 (1868). — Nakai, Fl. Sylv. Kor. **14**: 89, t. 20 (1923).

Adina Fauriei Léveillé in Fedde, Rep. Spec. Nov. **8**: 283 (1910).

Korea. Quelpaert: in ripis torrentium prope Hongno, *U.*

[1]See Vol. 16: 315.
[2]See Vol. 16: 316.

Faurie, no. 701, Oct. 1906, "1–2 m. alta"; in petrosis torrentium Hioton, *E. Taquet*, no. 1366, Aug. 22, 1908 (syntypes of *A. Fauriei;* isotypes and photo. of no. 1366 in A. A.).

Adina Fauriei was first identified with *A. rubella* by Nakai (l. c.).

Mussaenda Esquirolii Léveillé. — Rehder, l. c. 319 (1935). — Handel-Mazzetti, Symb. Sin. **7**: 1019 (1936).

Tarenna incerta Koorders & Valeton. — Rehder in Jour. Arnold Arb. **16**: 321 (1935).

Webera pallida Franchet ex Brandis, Ind. Trees, 378 (1906).
Webera Cavaleriei Léveillé.
Webera Henryi Léveillé.

When discussing this species in 1935, I had not yet seen the types of *Webera pallida* Franch. Visiting Paris later in the same year, I had the opportunity of examining the fruiting and flowering specimens of Delavay 902, labeled by Franchet *Webera pallida* which must be considered the types, though Brandis unfortunately did not cite any numbers, but only Henry and Delavay as collectors, and also a specimen or specimens from Upper Burma collected by Smales. It is probably on the last named specimen that the description of the fruit as "a yellow drupe, seeds 4–6" is based, for neither Henry's nor Delavay's specimens have fruits with as many seeds; in the former I found the number of seeds 1–3, in the latter 2–3. In the Philippine specimens, the number is usually 1 or 2, but Merrill (in Philipp. Jour. Sci. **17**: 469) states that he found as many as 5 seeds in specimens otherwise indistinguishable. Since seeing Delavay's specimens I have no further doubt that *Webera pallida* Franch. is identical with *T. incerta.*

To *Tarenna incerta* belongs Cavalerie nos. 3053 and 3585 referred by Léveillé to "*Lindera megaphylla* Brandis."

Ixora Henryi Léveillé. — Rehder in Jour. Arnold Arb. **16**: 322 (1935).

In Flore du Kouy-Tchéou, 367, Léveillé cites as a synonym *Ixora Cavaleriei,* a name apparently never validly published.

Psychotria Henryi Léveillé. — Merrill in Lingnan Sci. Jour. **5**: 176 (1927). — Rehder in Jour. Arnold Arb. **16**: 322 (1935).

Psychotria Prainii Léveillé. — Rehder in Jour. Arnold Arb. **16**: 322 (1935).

Ficus rufipes Léveillé & Vaniot in Mem. Acad. Ci. Art. Barcelona, ser. 3, **6**: 148 (Ficus Spec. China, 16) (1907); in Fedde, Rep. Spec. Nov. **4**: 86 (1907), pro parte, quoad specim. Esquirol 75, 76. — Handel-Mazzetti, Symb. Sin. **7**: 95 (1929), in nota.

China. Kweichou, add: Ouang-mou, *J. Esquirol*, nos. 75, 76, June 1904 (syntypes of *Ficus rufipes;* photo. in A. A.).

Handel-Mazzetti (l. c.) points out that of the syntypes of *Ficus rufipes* only Cavalerie 340 belongs to *F. foveolata*, while Esquirol 75 and 76 belong to the Rubiaceae (see also Jour. Arnold Arb. **17**: 75). Esquirol 75 and 76 consist of one branch with an inflorescence and some detached leaves in a pocket with a single label and mounted on one sheet.

Lasianthus Hartii Franchet. — Merrill in Lingnan Sci. Jour. **13**: 49 (1934). — Rehder in Jour. Arnold Arb. **16**: 323 (1935).

Canthium Dunnianum Léveillé.

Canthium Dunnianum was identified with *Lasianthus Hartii* already in 1934 by Merrill (l. c.).

Paederia scandens (Lour.) Merrill. — Rehder, l. c. 324 (1935). — Handel-Mazzetti, Symb. Sin. **7**: 1023 (1936).

Paederia Esquirolii Léveillé.
Paederia Dunniana Léveillé.
Paederia Mairei Léveillé.

Paederia yunnanensis (Lévl.), comb. nov.

Paederia tomentosa Bl. var. *purpureo-coerulea* Léveillé & Vaniot. — Vide Rehder l. c. sub *P. Wallichii*.

Paederia Bodinieri Léveillé, Fl. Kouy-Tchéou, 371 (1915), non Léveillé (1914). — Handel-Mazzetti in Sinensia, **5**: 21 (1934); Symb. Sin. **7**: 1023 (1936).

Cynanchum yunnanense Léveillé. — Vide Rehder, l. c., sub *P. Wallichii*.

Paederia Wallichii "Hook. f." ex Rehder in Jour. Arnold Arb. **16**: 325 (1935); non Hooker f.

Paederia Rehderiana Handel-Mazzetti, Symb. Sin. **7**: 1377 (1936).

When referring *P. Bodinieri* as a synonym to *P. Wallichii*, I had seen no Himalayan material of the latter and relied on a comparison made at Kew. As Handel-Mazzetti has seen the type and states (in Sinensia **5**: 21) that it differs in several good characters from *P. Bodinieri*, I follow him in accepting the latter as a distinct species.

Paederia Cavaleriei Léveillé. — Merrill in Lingnan Sci. Jour. **7**: 323 (1929). — Rehder, l. c. 326 (1935). — Handel-Mazzetti, Symb. Sin. **7**: 1023 (1936).

Prismatomeris Labordei (Lévl.) Merrill, comb. nov.

Canthium Labordei Léveillé in Fedde, Rep. Spec. Nov. **13**: 178 (1914); Fl. Kouy-Tchéou, 368 (1915).

Lasianthus Labordei (Lévl.) Rehder in Jour. Arnold Arb. **13**: 340 (1932); **16**: 323 (1935).

Dr. E. D. Merrill informs me that he has referred *Canthium Labordei*

to the genus *Prismatomeris* in a paper sent some time ago for publication to Sunyatsenia; that paper is probably now in press and may be out even before the present paper is published.

CAPRIFOLIACEAE[1]

Viburnum Cavaleriei Léveillé. — Rehder in Jour. Arnold Arb. **16:** 329 (1935).

Handel-Mazzetti (Symb. Sin. 1036. 1936) refers this species as a synonym to *V. chinshanense* Graebn., but as I pointed out (l. c.), the species though closely related to *V. chinshanense,* seems to be sufficiently distinct to be maintained as a species.

Viburnum foetidum Wall. var. **ceanothoides** (C. H. Wright) Handel-Mazzetti, Symb. Sin. **7:** 1038 (1936).

Viburnum ajugifolium Léveillé.
Viburnum Valbrayi Léveillé.
Viburnum foetidum Wallich ex Rehder in Jour. Arnold Arb. **16:** 331 (1935), quoad synon. et specim. citata.

Viburnum ceanothoides C. H. Wright seemed to me always quite a distinct form, but I hesitated to publish it as a new variety of this rather polymorphous species.

Triosteum himalayanum Wallich ex Roxburgh, Fl. Ind. **2:** 180 (1824).

Echium connatum Léveillé, Cat. Pl. Yun-Nan, 22 (1915).

CHINA. Yunnan: vallées humides de Tai-Hai, 3000 m., *E. E. Maire,* July 1912, "fl. verdâtres" (holotype of *Echium connatum;* photo. in A. A.).

Lonicera Pampanini Léveillé. — Rehder in Jour. Arnold Arb. **16:** 338 (1935), synon. exclud. — Handel-Mazzetti, Symb. Sin. **7:** 1048 (1936).

Through the kindness of Sir William Wright Smith, I have recently seen the type of *L. Henryi* var. *setuligera* W. W. Sm. which I had from the description identified with *L. Pampanini,* and I find that it is indeed a variety of *L. Henryi* Hemsl. To this variety belongs Tsai 57179 from Yunnan.

COMPOSITAE[2]

Vernonia arborea Hamilton in Trans. Linn. Soc. **14:** 218 (1825).

Vernonia Vanioti Léveillé in Fedde, Rep. Spec. Nov. **12:** 531 (1913); Cat. Pl. Yun-Nan, 56 (1916). — **Synon. nov.**

[1]See Vol. **16:** 328.
[2]See Vol. **16:** 340.

China. Yunnan: collines calcaires de Lo-kou, *E. E. Maire*, July 1912, "arbuste, feuilles rugueuses caduques, fl. violettes" (holotype of *V. Vanioti;* photo. in A. A.).

Vernonia Vanioti was determined by Gagnepain as *V. arborea* Ham. forma according to his label on the type sheet but Léveillé's name is not mentioned as a synonym in his treatment of the genus in Lecomte, Fl. Gén. Indochine, **3**: 462–487 (1924). The specimen has ovate-lanceolate or oblong-lanceolate glabrescent leaves and in these characters resembles the typical form of this apparently variable species.

In his manuscript publication Cat. Ill. Pl. Seu-Tchouen (1918) Léveillé published as plate 21 a crude illustration of this plant under the name *V. Vaniotiana.*

Vernonia volkameriaefolia DeCandolle, Prodr. **5**: 32 (1836).

Vernonia Esquirolii Léveillé in Fedde, Rep. Spec. Nov. **11**: 304 (1912), non Vaniot (1907). — **Synon. nov.**

Vernonia Leveillei Fedde ex Léveillé, Fl. Kouy-Tchéou, 109 (1914).

China. Kweichou: rivière de Pa-oua, *J. Esquirol,* no. 2679, March 1911, "arbrisseau" (holotype of *V. Esquirolii;* photo. in A. A.).

Vernonia Esquirolii was identified as *V. volkameriaefolia* by Gagnepain according to a note on the type specimen dated Nov. 1920, but Léveillé's name is not cited in Lecomte, Fl. Gén. Indochine.

Vernonia saligna DeCandolle, Prodr. **5**: 33 (1836).

Vernonia Martini Vaniot in Bull. Acad. Intern. Géog. Bot. **12**: 124 (1903). — Léveillé, Fl. Kouy-Tchéou, 109 (1914). — **Synon. nov.**

Vernonia Seguini Vaniot, l. c. 241 (1903). — Léveillé, l. c. (1914). — **Synon. nov.**

China. Kweichou: sous-prefecture de Tchen-lin-théou à Ou-la-gay, *L. Martin* in herb. *Bodinier,* no. 1922, Oct. 9, 1897, "fleurs violettes" (holotype of *V. Martini;* photo. in A. A.); environs de Hoang-ko-chou, dans les terres incultes, *J. Seguin* in herb. *Bodinier,* no. 2472, Oct. 9, 1898 (holotype of *V. Seguini;* photo. in A. A.).

Vernonia Martini and *V. Seguini* were identified with *V. saligna* by Guillaumin according to a note on the type sheet, but Vaniot's names are not cited as synonyms in Lecomte, Fl. Gén. Indochine.

Vernonia papillosa Franchet in Jour de Bot. **10**: 368 (1896). — Léveillé in Cat. Pl. Yun-Nan, 56 (1916).

? Vernonia arbor Léveillé in Fedde, Rep. Spec. Nov. **11**: 304 (1912); Fl. Kouy-Tchéou, 109 (1914). — **Synon. nov.**

China. Kweichou: halte près Hoang-guy-tun, route de Long-tchong, *J. Esquirol,* no. 2729, Oct. 15, 1911, "arbre 6 m." (holotype of *V. arbor;* photo. in A. A.).

Vernonia arbor was doubtfully referred to *V. papillosa* by Gagnepain according to a note on the type specimen; however, the acuminate bracts of the involucre, described as obtuse by Franchet, are certainly not in favor of this identification.

Vernonia extensa DeCandolle, Prodr. **5:** 33 (1836).

Vernonia subarborea Vaniot in Bull. Acad. Intern. Géog. Bot. **12:** 126 (1903). — Léveillé, Fl. Kouy-Tchéou, 109 (1914). — **Synon. nov.**

CHINA. K w e i c h o u : montèe de torrent de Koon-lin, *L. Martin* in herb. *Bodinier,* no. 2568, Feb. 14, 1899, "sous-arbrisseau de 2.5 m., fleurs rosées" (holotype of *V. subarborea;* photo. in A. A.).

Vernonia subarborea was determined by Gagnepain according to a note on the type specimen as *V. extensa* DC. with which it seems to agree very well.

Aster lofouensis Léveillé & Vaniot in Fedde, Rep. Spec. Nov. **8:** 281 (1910). — Léveillé, Fl. Kouy-Tchéou, 86 (1914).

CHINA. K w e i c h o u : Lo-fou, *J. Cavalerie,* March 1907 (holotype; photo. in A. A.).

This is a very distinct and well-marked species characterized by slender ligneous branches and very narrow linear leaves up to 5 cm. long and 2–3 mm. broad, sessile and auriculate at base, subcoriaceous, scabrid above with deeply impressed midrib, tomentose beneath, with strongly revolute margin. The flower heads are borne in loose panicles or corymbs at the end of slender branches; the branchlets of the inflorescence are 1.5–6 cm. long terminated by 1–3 heads.

Microglossa albescens (DC.) Clarke, Compos. Ind. 59 (1876). — Léveillé, Cat. Pl. Yun-Nan, 40 (1915).

Aster Cavaleriei Vaniot & Léveillé in Bull. Soc. Bot. France, **53:** 549 (1906). — Léveillé, Fl. Kouy-Tchéou, 82 (1914). — **Synon. nov.**

CHINA. K w e i c h o u : pentes de la rivière Tien-sen-kiao, *J. Cavalerie,* no. 1895, Nov. 1904, "fl. bleu" (holotype of *Aster Cavaleriei;* photo. in A. A.).

Aster Cavaleriei was referred to *M. albescens* by C. C. Chang according to a note on the type specimen.

Conyza viscidula Wall. ex DeCandolle, Prodr. **5:** 383 (1836).

Blumea conyzoides Léveillé & Vaniot in Fedde, Rep. Spec. Nov. **7:** 22 (1909). — Léveillé, Fl. Kouy-Tchéou, 89 (1914). — **Synon. nov.**

CHINA. K w e i c h o u : Lo-fou, *J. Cavalerie,* no. 3310, April 1907 (holotype of *Blumea conyzoides;* photo. in A. A.).

According to a note on the type sheet, *Blumea conyzoides* was identified by Gagnepain in 1920 with *Conyza viscidula,* but the name is not

cited as a synonym in Lecomte, Fl. Gén. Indochine. Merrill (in Lingnan Sci. Jour. **15**: 428. 1936) cites *Blumea conyzoides* as a synonym of *Microglossa pyrifolia* (Lam.) Ktze.; he apparently did not see the type specimen, since he does not mention the name *Blumea conyzoides* in the discussion.

Blumea lanceolaria (Roxb.) Druce in Rep. Bot. Exch. Club Brit. Isles, **4**: 609 (1917). — Merrill in Trans. Am. Philos. Soc. n. ser. **24**^{2}: 387 (Comm. Loureiro Fl. Cochinch.) (1935).

Bileveillea (*Blumea*) *granulatifolia* Léveillé in Fedde, Rep. Spec. Nov. **8**: 449 (1910); Fl. Kouy-Tchéou, 87 (1914). — **Synon. nov.**

Blumea granulatifolia Léveillé, l. c. (1914), pro synon. praecedentis.

China. Kweichou: Lo-fou, *J. Cavalerie*, no. 3708, March 1909, "couleur jaune" (holotype of *Bileveillea granulatifolia*, 3 sheets; photos. in A. A.).

At the suggestion of Dr. E. D. Merrill, I compared Léveillé's species with *Blumea lanceolaria* (Roxb.) Druce (*B. myriocephala* DC.) and find that there can be little doubt of their identity.

Chrysanthemum indicum Linnaeus, Spec. Pl. 889 (1753).

Chrysanthemum indicum L. var. *coreanum* Léveillé in Fedde, Rep. Spec. Nov. **10**: 351 (1912).

Korea. Quelpaert: in littore Syckem, *E. Taquet*, no. 4664, Feb. 1908 (holotype of *C. indicum* var. *coreanum;* photo. in A. A.).

Taquet's specimen does not seem to differ from *C. indicum* L.

Senecio Walkeri Arnott, Pug. Pl. Ind. Or. no. 103 (1836). — DeCandolle, Prodr. **6**: 364 (1837).

Senecio araneosus DeCandolle, l. c. (1837).

Vernonia spelaeicola Vaniot in Bull. Acad. Intern. Géog. Bot. **12**: 123 (1903). — Léveillé, Fl. Kouy-Tchéou, 109 (1914). — **Synon. nov.**

Vernonia Esquirolii Léveillé in Fedde, Rep. Spec. Nov. **4**: 331 (1907). — **Synon. nov.**

China. Kweichou: environs de Hoang-ko-chou, fond d'une grande grotte, *L. Martin* in herb. *Bodinier*, no. 2570, Feb. 23, 1899, "tiges lianeuses, fleurs blanches" (holotype of *Vernonia spelaeicola;* photo. in A. A.); forêts, *J. Esquirol*, no. 581, Dec. 1906, "retombant du sommet des arbres" (holotype of *Vernonia Esquirolii;* photo. in A. A.).

Vernonia spelaeicola and *V. Esquirolii* were identified with *V. araneosa* by C. C. Chang according to a note on the type sheets of the two species.

Senecio Walkeri has priority by one year over the generally accepted name *S. araneosa*.

Senecio saxatilis Wallich ex DeCandolle, Prodr. **6**: 367 (1836).

Senecio Gentilianus Vaniot in Bull. Acad. Intern. Géog. Bot. **11**: 350 (1902). — Léveillé, Fl. Kouy-Tchéou, 105 (1914).

CHINA. Kweichou: environs de Kouy-yang, dans les montagnes â Lau-tsong-koan, *S. Bodinier*, no. 1916, Aug. 1917 (holotype of *S. Gentilianus;* photo. in A. A.).

Senecio Gentilianus was tentatively identified by L. Diels in 1911 with *S. saxatilis*, a determination later confirmed by C. C. Chang according to notes on the type sheet.

ADDITIONS AND CORRECTIONS

Keteleeria Davidiana (Bertrand) Beissner. — Rehder in Jour. Arnold Arb. **10**: 109 (1929).

Keteleeria Esquirolii Léveillé. — Flous in Bull. Soc. Hist. Nat. Toulouse, **70**: 324 fig. (1936); Trav. Lab. For. Toulouse, II. 4, art. **1**: 52. fig. (1936).

Podocarpus Mairei Lemée & Léveillé.

Keteleeria Esquirolii is maintained by Miss Flous as a distinct species chiefly separated from *K. Davidiana* by the bract being abruptly contracted at the apex into a short point, not 3-lobed and by the broader rounded scales. It seems doubtful, however, whether these characters are constant and reliable, and for the present I prefer to refer *K. Esquirolii* as a synonym or perhaps a geographical form to *K. Davidiana*. *Podocarpus Mairei* which is based on a branch with staminate flowers, is not mentioned by Miss Flous; according to her classification, it is apparently referable to *K. Evelyniana* Mast. which resembles *K. Davidiana* in the shape of the scales and bracts, but differs in the longer, somewhat acutish and indistinctly mucronulate leaves.

Salix Wilsonii Seemen. — Rehder, op. cit. **10**: 112 (1929). — Hao in Fedde, Rep. Spec. Nov. Beih. **93**: 41, pl. 1, fig. 2 (1936).

Salix Argyi Léveillé.

The treatment of this and the following species of Chinese willows by Hao agrees mostly with that in the previous publications of the writer.

Salix dodecandra Léveillé. — Rehder, l. c. 112 (1929). — Hao, l. c. 45, pl. 4, fig. 7 (1936).

Salix anisandra Léveillé & Vaniot. — Rehder, l. c. 113 (1929).

Salix Camusii Léveillé. — Rehder, l. c. 115.

Salix Cavaleriei Léveillé. — Rehder, l. c. 113 (1929); **17**: 65 (1936). — Hao, l. c. 46 (1936).

Salix polyandra Léveillé.

Salix Pyi Léveillé.

Salix yunnanensis Léveillé.

Salix angiolepis Léveillé. — Rehder, l. c. 113 (1929). — Hao, l. c. 40, pl. 1, fig. 1 (1936).

Salix erioclada Léveillé. — Rehder, l. c. 115 (1929); **17:** 65 (1936). — Hao, l. c. 70, pl. 20, fig. 40 (1936).

Salix luctuosa Léveillé. — Rehder, l. c. 115 (1929); **17:** 66 (1936). — Hao, l. c. 78 (1936).

Salix Wallichiana Andersson. — Rehder, l. c. 116 (1929). — Hao, l. c. 92 (1936).

Salix funebris Léveillé.
Salix Mairei Léveillé.
Salix pachyclada Léveillé. — Rehder, l. c. 116 (1929).

Salix andropogon Léveillé. — Rehder, l. c. (1929). — Hao, l. c. 109, pl. 42, fig. 83 (1936).

Salix variegata Franchet in Nouv. Arch. Mus. Paris, sér. 2, **10:** 82 (Pl. David. 120) (1887). — Hao, l. c. 110 (1936).

Salix Duclouxii Léveillé. — Rehder, l. c. 117 (1929); **17:** 66 (1936).
Salix Duclouxii var. *kouytchensis* Léveillé.
Salix kouytchensis (Lévl.) Schneider. — Rehder, l. c. 117 (1929).

The close relationships of the synonyms cited above with *S. variegata* and *S. Bockii* Seemen has been discussed by all authors dealing with these species. In 1929, Handel-Mazzetti referred *S. kouytchensis* to *S. Duclouxii* as a synonym. In 1936, Hao united the species cited above as synonyms and also *S. Bockii* with *S. variegata,* since they cannot be separated by stable and reliable characters and are also quite uniform in their appearance. It may be even doubted, if *S. Schneideriana,* a new species based by Hao on Schneider no. 3273 which Schneider himself had referred (in herb. Arnold Arb.) to *S. Bockii,* is specifically different; one might consider it possibly an extreme form with much longer, narrow-oblong glabrescent leaves.

Celtis Biondii var. **heterophylla** (Lévl.) Schneider. — Rehder, l. c. 123 (1929).

Celtis Bungeana var. *heterophylla* Léveillé.
Celtis Leveillei Nakai. — Metcalf in Sunyatsenia, **3:** 114 (1936).

Ficus foveolata Wallich ex Miquel. — Rehder, l. c. 124 (1929); **17:** 75 (1936).

Ficus rufipes Léveillé & Vaniot. . . . pro parte, quoad Cavalerie 340.

On page 125, line 9, for "type of *F. rufipes*" read "syntype of *F. rufipes*." The two other syntypes, Esquirol 75 and 76 belong to *Psychotria Prainii* Lévl. (see above, p. 248).

Ficus Martini Léveillé & Vaniot. — Rehder, l. c. 127 (1929); **17:** 75 (1936). — Merrill in Sunyatsenia, **1:** 54 (1930).

Merrill had already reduced in 1930 (l. c.) his *F. kwangtungensis* to *F. Martini*, a correction I had overlooked; therefore the words "Synon. nov." line 8 on p. 76 (op. cit. vol. 17) should be deleted.

Ficus Esquirolii Léveillé & Vaniot. — Rehder, op. cit. **17:** 79 (1936). — Handel-Mazzetti, Symb. Sin. **7:** 1370 (1936).

Ficus Vanioti Léveillé, Fl. Kouy-Tchéou, 434 (1915), pro parte, not Léveillé (1909). — Rehder, l. c. 82 (1936).

In the citation of specimens for "syntype of *F. Vanioti*" read "cited in Fl. Kouy-Tchéou under *F. Vanioti*." *Ficus Vanioti* Lévl. (1909) has been identified as *Aglaia tetrapetala* (Pierre) Pellegr. (see above p. 211).

Clematis Pavoliniana Pampanini. — Rehder, op. cit. **10:** 187 (1929). — Chun in Sunyatsenia, **1:** 231 (1934).

Clematis Finetiana Léveillé & Vaniot.

Stauntonia obovata Hemsley. — Rehder, op. cit. **17:** 320 (1936). — Wu in Notizbl. Bot. Gart. Mus. Berlin-Dahlem, **13:** 372 (1936).

Akebia Cavaleriei Léveillé.

Illigera Dunniana Léveillé in Fedde, Rep. Spec. Nov. **9:** 326 (1911); Fl. Kouy-Tchéou, 74 (1914).

Frutex scandens, caule leviter striato. Folia 3-foliata, petiolo pilosulo 6 cm. longo vel longiore; foliola ovata vel elliptico-ovata, 4.5–10 cm. longa, breviter acuminata, basi rotundata vel subcordata, supra pilis accumbentibus asperata in costa longius et densius fulvo-pilosa, subtus tota facie laxe in costa venisque elevatis densius flavo-pilosis, reticulata, nervis utrinsecus 3 vel 4 trabeculis elevatis connexis. Inflorescentia paniculata elongata, dense fulvo-pilosula, ramulis cymosis 0.5–3 cm. longis, pedicellis brevissimis; flores flavi vel rubescentes; ovarium ovoideum, dense fulvo-pilosum; sepala oblonga, 6 mm. longa, acutiuscula, extus dense pubescentia et glandulosa, intus puberula; petala sepalis similia sed paullo angustiora et breviora; stamina petalis triente breviora filamentis pilosis et glandulosis, antheris ovalibus circ. 1 mm. longis dorso glandulosis; staminodia 2 mm. longa, oblongo-lanceolata, concava, triente inferiore in stipitem attenuata; disci glandulae minimae; stylus petalis paullo breviora, satis dense pilosus, apicem versus in stigma peltatum lobulatum dilatatus.

CHINA. K w e i c h o u : ouest de Lo-fou, sous-bois, *J. Cavalerie*,

no. 2719, Nov. 1905, "longue liane à fl. jaunâtres ou rougeâtres" (holotype; photo. and fragments in A. A.).

As *I. Dunniana* represents evidently a distinct species, a more detailed description is given above to supplement Léveillé's brief one. The type specimen is rather fragmentary; it consists of two nearly bare branchlets with detached leaflets and flowers. The species belongs to Dunn's Appendiculatae and is similar to *I. Pierrei* Gagnep. in its inflorescence and shape of leaflets, but is easily distinguished by the pubescent leaflets and flowers.

Capparis cantoniensis Loureiro. — Rehder in Jour. Arnold Arb. **17**: 332 (1936).

Cudrania Bodinieri Léveillé.

Vanieria Bodinieri (Lévl.) Chun. — Merrill in Lingnan Sci. Jour. **5**: 64 (1927).

Rosa cymosa Trattinick. — Rehder, l. c. 339 (1936).

Rosa microcarpa Lindley. — Boulenger in Bull. Jard. Bot. Bruxelles, **14**: 202 (1936).

Boulenger cites as synonyms *R. Chaffanjoni*, *R. Bodinieri* and *R. Esquirolii* of Léveillé & Vaniot and *R. Cavaleriei* Lévl.

Rosa lucidissima Léveillé. — Rehder op. cit. **13**: 316 (1932).

Boulenger (l. c. 196) cites *R. lucidissima* as a synonym of *R. laevigata* Michx. and he also cites as another synonym with a query *R. Argyi* Léveillé (in Bull. Soc. Bot. France **55**: 56, 1908) which I have not seen.

Rosa acicularis Lindley. — Rehder, op. cit. **13**: 317 (1932). — Boulenger l. c. 131 (1936).

Rosa korsakoviensis Léveillé.

Rosa Marrettii Léveillé. — Rehder op. cit. **13**: 318 (1932).

Boulenger (l. c. 138) cites *R. Marrettii* Lévl. as a synonym of *R. cinnamomea* L.; he also refers *R. daurica* Pallas and *R. amblyotis* C. A. Mey. to *R. cinnamomea* as synonyms.

Andrachne Esquirolii Léveillé. — Rehder, op. cit. **14**: 229 (1933). — Handel-Mazzetti, Symb. Sin. **7**: 1372 (1936).

Handel-Mazzetti refers to *A. Esquirolii* as synonyms his *A. attenuata* and *A. persicariaefolia* Lévl. He also publishes as a new combination *A. Esquirolii* var. *microcalyx* (*A. attenuata* var. *microcalyx* Hand.-Mazz.).

(*To be concluded in No. 4*)

Herbarium, Arnold Arboretum,
Harvard University.

BIBLIOGRAPHICAL NOTES

ETHELYN M. TUCKER

Andrews, Henry C. Roses. Henry C. Andrews, an English artist and botanist, who resided in London, and flourished between the years 1794 and 1830, published a series of colored engravings, with descriptions of rare plants, entitled "The Botanist's Repository" (10 vol., 1797–1815?) and monographs on the heaths, geraniums and roses. Beyond this we know little of him, not even his second name.

"Roses" was apparently a very rare work not to be found in many libraries nor listed in sales catalogues, and about which little can be learned. The full title of this work is: "Roses; or, A monograph on the genus Rosa containing coloured figures of all the known species and beautiful varieties, drawn, engraved, described, and coloured from the living plants." 2 vol. London. 1805–28. 4°. [122] colored plates. The British Museum gives only the entry, no enlightening notes, but it is quite evident that the work was published in parts and that upon completion the plates were rearranged. As issued the plates were unnumbered, numbers being assigned to species and varieties only in the indexes according to the rearrangement, and although the index number of 129 is accepted by Pritzel as the number of plates there are in reality but 122 plates, more than one rose being often figured on a plate.

Redouté in the preface to his "Les Roses" speaks slightingly of Andrews' work, remarking that it is far from satisfying to naturalists and amateurs and that although the drawings are in natural size and several roses are presented in their complete form, they are for the most part grouped without art and without grace, the outlines of many presenting even a grotesque form. He grudgingly admits, however, that the monograph offers a sort of merit which in spite of its imperfections has made it eagerly received in England, as it gives drawings of a large number of roses little distributed in cultivation and which have never before been figured. While there is no doubt much truth in Redouté's criticism, it should not be taken too seriously, as the only two other works devoted exclusively to roses which preceded Redouté's own work, those of Mary Lawrance and Roessig, also received their share of caustic criticism. All three works in later years proved their importance in the literature of this genus. It is then with interest that we turn to an examination of the dates of Andrews' work.

A large number of the plates bear no date, notwithstanding the "direction of the Act" (then in force, but unfortunately allowed to lapse) that

DATES OF PUBLICATION.

Number	Date
	Vol. I
1	n.d.
2	
3	[1828]
4	after 1811
5	n.d.
6	1806
7	1806
8	[1824]
9	
10	n.d.
11	1806
12	drawn 1810
13	1805
14	1806
15	1806
16	1806
17	1806
18	n.d.
19	1806
20	1806
21	1805
22	n.d.
23	1805
24	1806
25	drawn 1826
26	n.d.
27	[1807]
28	1816? or 1817?
29	1805
30	drawn 1824
31	drawn 1816
32	[1821]
33	
34	drawn 1810?
35	n.d.
36	[1817]
37	1805
38	after 1823
39	[1810]
40	drawn 1808
41	after 1820
42	n.d.
43	[1817]
44	drawn 1822
45	1806
46	1805
47	1806
48	[1810]
49	1805
50	1805
51	n.d.
52	1806
53	1806
54	1806
55	[1826]
56	1806
57	after 1816
58	drawn 1810
59	1805
60	1806
61	[1824]
62	
63	1806
64	1805
65	drawn 1815?
	Vol. II
66	1805
67	n.d.
68	[1805]
69	after 1816
70	[1817]
71	[1817]
72	1806
73	after 1826
74	n.d.
75	drawn 1819
76	drawn 1821
77	[1810]
78	1806
79	drawn 1812
80	
81	after 1815
82	drawn 1823
83	[1805]
84	drawn 1822
85	[1826]
86	
87	drawn 1827
88	1806
89	n.d.
90	[1804]
91	n.d.
92	1809
93	1805
94	1805
95	[1828]
96	drawn 1822
97	n.d.
98	drawn 1826?
99	n.d.
100	[1817]
101	1860 [sic], 1806
102	1806
103	1806
104	n.d.
105	[1808]
106	[1822]
107	[1825]
108	drawn 1827
109	n.d.
110	[1809]
111	1805
112	[1821]
113	
114	drawn 1809
115	drawn 1810
116	1817
117	1806
118	1824
119	n.d.
120	after 1817
121	1806
122	[1804]
123	n.d.
124	1806
125	n.d.
126	[1817]
127	[1817]
128	1822
129	[1807]

each should be dated. In some cases where the plates were undated the text informs us that the drawing was made on a certain date, while in other cases a watermark on either the plate itself or the accompanying page of text is our only clue. These do not definitely place the date of publication but give an approximate date and assure us that the plates could not have been published earlier. Volume one has in addition to its title-page, dated 1805, an illustrated title-page figuring a rose tree in colors, with the caption "Miniature figure of the R, villosa or Tree Rose as it flowered in the Garden of the Hon^{ble}, W, Irby, near Farnham in, 1810." We can, therefore, place little dependence on title-page dates, as the actual dates of publication, but the dates of the drawings so inconsistent with title-page dates, showing an arbitrary grouping together of plates in the two volumes, are in themselves of interest.

It is probable that the title-page for 1805 together with Introduction were intended for the entire work and printed upon the inception of the work, that the plates were issued in fascicles as drawn and later brought together in the two volumes. Following the introduction in Volume I, we find "Remarks on the Factitious increase of the Genus Rosa," wherein Andrews writes, "Upwards of twenty years have elapsed since the commencement of this work till its conclusion. We have separated the work into two parts or volumes, the first containing all the larger roses, the second nearly all the smaller roses." Each volume, therefore, contains plates dated from 1805 to 1826 or 1827.

In the foregoing table the precise date of publication is without further indication, the date of drawing is so indicated, and the date in brackets is that of the watermark. Where two numbers are figured on one plate they are indicated by a brace.

Wallich, Nathaniel. Tentamen florae napalensis illustratae.

Only two fascicles of this rare work by Nathaniel Wallich (formerly Nathan Wolff) were ever published. They comprise 64 pages and 50 plates, the first twenty-five plates in colors. Page 64 ends abruptly in the middle of a sentence. In the Arboretum copy, the two fascicles are bound together in ½ crushed Levant, the cover of "1. Fascicle. Calcutta and Serampore. 1824," mounted on the face of the volume. There is no title-page and no cover for fascicle 2, but as catalogues consulted give the date 1826, or [1824]–26, it would appear that the second fascicle had a cover bearing the date 1826. From the arrangement of the pages and plates, the contents of each fascicle may be easily judged and the following citation safely assumed as correct:

Fasc. i, pages 1–24, plates 1–25. 1824.
" ii, " 25–64, " 26–50. 1826.